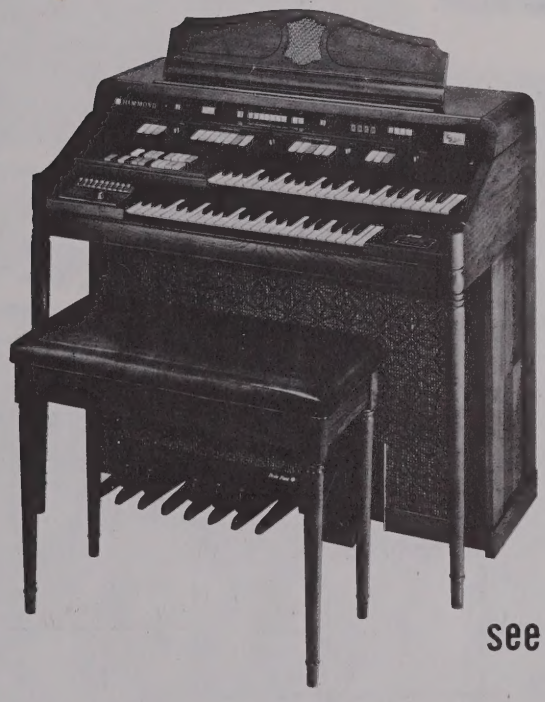
SERVICE MANUAL

126000 SERIES



CAUTION!
see safety notice inside

HOOO-006062

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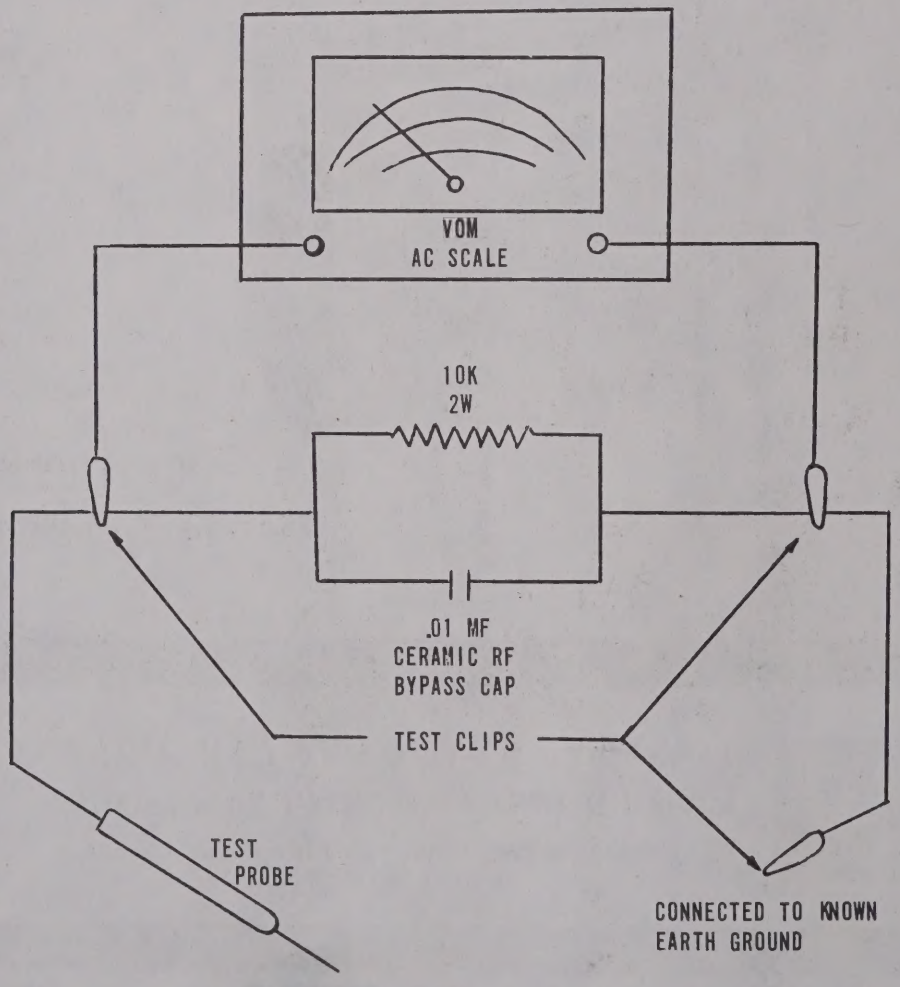
SAFETY NOTICE

Great care has been taken in the design and manufacture of this product to assure that no shock hazard exists on any exposed metal parts. Internal service operations can expose the technician to hazardous line voltages and accidentally cause these voltages to appear on exposed metal parts during repair or reassembly of product components. To prevent this, work on these products should only be performed by those who are thoroughly familiar with the precautions necessary when working on this type of equipment.

To protect the user, it is required that all enclosure parts and safety interlocks be restored to their original condition and the following tests be performed before returning the product to the owner after any service operation.

Plug the AC line cord directly into a line voltage AC receptacle (do not use an isolation transformer for this test) and turn the product on. Connect the network (as shown below) in series with all exposed metal parts and a known earth ground such as a water pipe or conduit. Use an AC VOM of 5,000 ohms per volt or higher sensitivity to measure the voltage drop across the network. Move the network connection to each exposed metal part (metal chassis, screw heads, knobs and control shafts, escutcheon, etc.) and measure the voltage drop across the network. Reverse the line plug and repeat the measurements. Any reading of 4 volts RMS or more is excessive and indicates a potential shock hazard which must be corrected before returning the product to the user.



The HAMMOND Romance Series 126

This Hammond captures all the magic of musical moments...and the magic is the discovery of the music in you. With 126 your creativity is limited only by your imagination. All the tabs, buttons, and easy play Hammond features offer you music that's only one finger away...

Brite Foot™ will find and play correct pedal notes for you. Automatic Bass Walk provides pedal patterns to make you believe a string bass is playing right along with you. Auto Vari®28 changes rhythm patterns the way a live drummer varies his playing. Note-A-Chord™ locks One Finger Chords or full chords so you won't lose your place. And One Finger Chords with Autochord® give you alternating chord and pedal notes in any rhythm pattern selected. Add to these advantages dual channel Leslie animation and the new Hammond Sound Simulator SSI.

Recapture your favorite melodies and instrumental sounds on the 126. It's easy and hours of fun. With Hammond, the new star of music is you.

PRODUCT DATA SHEET

- **Custom LSI Tone Generator**
- **Two 44-Note Keyboards**
  13-Note Pedalboard
- **Upper Voices**
  Organ Voices: Tibia 16′, String 16′, Diapason 8′, Tibia 8′, String 8′, Horn 8′, Tibia 4′, Accent
  Instrumental Voices: Cello, Accordion, Harpsichord, Banjo, Piano
  Special Effects: Syntha Echo, Variable Sustain, Repeat Tibias, Repeat Upper
  Sound Simulator SSI: Sax, Clarinet, Trombone, French Horn, Cornet, Piccolo, Pizzicato, Novelty, Chirp, Off, Variable Volume Selector
- **Lower Voices**
  Flute 8′, String 8′, Horn 8′, Accent
- **Pedals**
  Diapason 16′, Flute 8′, Bass Guitar, Sustain, Variable Pedal Volume
- **Accents**
  Organ Voices, Lower Manual
- **Organ Controls**
  Brilliance, Volume Soft
- **20—One Finger Chords**
- **Autochord®**
- **Note-A-Chord™**
- **Auto Vari®28**
  7 Rhythm patterns, each with four variations: Waltz, Ballad, Rock, Jazz, March, Western, Latin. Plus Touch Control, Volume Selector, Tempo Selector and Measure Selector
- **Brite Foot™**
  On/Off,Rehearse/Perform
- **Bass Swing and Bass Walk**
- **Animation**
  Vibrato On/Off, Normal/Small; Leslie On Reverb, Leslie On Mains, Leslie On Tibias, Leslie Slow/Fast
- **Variable Sustain, Reverb, Repeat, Pedal Volume and Sound Similator Volume**
- **Headphone Jack**
- **Auxiliary Input Jack**
- **External Speaker Jack**
- **Speakers**
  One 12″Wide Range, One 8″for rotating Leslie® baffle
- **Padded Bench w/Music Storage**
- **Dimensions**
  42⅞″ W, 24″ D, 39¾″ H (47¾″ H with music rack up)
- **Weight**
  183 pounds including bench

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SECTION I
THEORY OF OPERATION

126100 THEORY OF OPERATION

The 126100 series organ is constructed from six basic systems - upper organ voices, upper instrumental voices, lower voices, bass, auto vari and sound simulator. In some areas an overlap of circuitry exists between the five systems, but for troubleshooting and description the systems can be considered separate and independent of each other.

SYSTEM 1 UPPER ORGAN VOICES (TIBIAS AND BRIGHTS)

The upper organ voices consist of two sub-groups - Tibias and Brights. The specific voices that fall within these sub-groups are:

TIBIAS	BRIGHTS
Tibia 16'	String 16'
Tibia 8'	Diapason 8'
Tibia 4'	String 8'
	Horn 8'

The generation of the upper Tibias and Brights begins on the Generator Board (124-000499). Transistor Q4 and its associated circuitry form a Hartley oscillator. The emitter output of Q4 is a 2MHZ sine wave signal. If vibrato is selected, a sine wave signal (generated by Q1 and Q2) leaves the collector of Q3 and frequency modulates the Hartley at a range between 3 and 7 hertz.

Transistor Q5 amplifies the 2MHZ signal sufficiently to drive the MOS IC5. IC5 divides the 2MHZ signal down to the 12 top octave frequencies (square waves) (A through G#) which clock divider-keyer IC's one through four.

When any of the 44 upper manual keys are held down —28 volts from the upper manual keying bus is transferred to the appropriate keying (time constant) circuits which, in turn, feed the correct input pins of a 429 LSI divider-keyer IC. Thus, the combination of keying inputs, MDD inputs, and power supply voltages (—14V, —28V, ground) at the 429 IC's allows four frequencies to be released into the bus amps. These frequencies are a 16' square wave, and 8' square wave, a 4' square wave, and a 2' staircase wave. Upon being released from the 429 IC's, these waveforms enter bus amps Q7, Q8, Q9, and Q10 respectively. After amplification by the bus amplifier, the signals combine at the staircase ladder network or travel directly to the appropriate output pins at J18.

The result of mixing at the staircase ladder network is the availability of square and staircase waves of various footages at the Generator Board output plug J18. The waveforms exist in the following sequences:

J18-1 ---------- 4' square waveform
J18-3 ---------- 2' staircase waveform
J18-5&6 ---------- 16' staircase waveform
J18-7&8 ---------- 16' square waveform
J18-9&10 ---------- 8' staircase waveform
J18-11 ---------- 8' square waveform

The foregoing complex waveforms leave the Generator Board at their respective pins and travel to the Upper Tibia and Bright stops on the Upper Manual and Pedal Tab Board (124-000506). At this point the Tibia and Bright Signals separate and run different paths. At this time, they will be dealt with separately.

TIBIAS

The selection of the 16', 8', or 4' upper Tibia stop allows a 16', 8', or 4' square wave to pass into the appropriate Tibia filter, After filtering, the Tibia signal becomes amplified by transistor Q1, travels through the Tibia accent network (Q5) or R16), and drives amplifier transistor Q2. Following amplification by Q2 and level adjustment by R17, the Tibia signal exits the Upper Manual and Pedal Tab Board at J57-1 and enters the Endblock Board at J54-22.

On the Endblock Board the Tibia signal enters the Tibia photocoupler. Because Darlington pair Q32 and Q33 are biased "ON" by negative voltage from R138 (due to keydown), the LED (Light Emitting Diode) portion of the photocoupler is also biased "ON". The light generated by the current flow through the LED reaches the LDR (Light Dependent Resistor) section of the photocoupler and sets the resistance value of the LDR to a relatively low level. Thus, the Tibia signal normally passes through the LDR at a constant amplitude and enters IC-2 for Main or Leslie channel selection. When the "Repeat Tibias" switch is thrown "ON", however, transistors Q32 and Q33 feed the LED with pulses driving it into conduction and cutoff alternately. The pulses are generated by operations occurring in the following sequence:

1) The activation of the Repeat Tibia switch accomplishes three operations. First the ground applied to the anode of D31 removes negative bias from Q32 and Q33, cutting the LED of the photocoupler completely off. Second, the ground applied to the anode of D31 also removes negative voltage from IC6C pin 6. This allows pins 8 and 9 of IC6 to short together and connects the emitter output of Q28 to the base input of Q32. Third, the ground at the anode of D20 turns transistor Q21 "OFF". With Q21 off, a high resistance (to ground) is developed at the cathode of D22.

2) With any upper key pressed, a load is applied to the base of Q12 which draws current. Accordingly, Q12 conducts and develops —28V across R96. This negative voltage travels over D22 which: a) pulses Q25 into conduction and b) holds Q23 off. As Q25 pulses on and off, it sends a positive pulse to the anode of PUT Q26, quickly turning it on. As Q25 remains "OFF", Q24 switches "ON". The turn on of Q24 decreases the gate voltage of Q26 assuring that the PUT will oscillate at a rate set by the rate potentiometer.

3) The output (spike) pulses on the gate of Q26 are differentiated and clamped to positive levels by C64, D26, and D27. The pulses are amplified and inverted by Q27-Q28. The emitter output of Q28 feeds the C65, R163

time constant for development of the proper pulse duration.

4) Following time constant control by C65 and R163, the negative repeat pulses travel through IC6C and drive Q32-Q33. The Darlington pair then applies a "chopped" current flow through the LED of the photocoupler. This modulates the Tibia signal with the repeat control pulses.

The foregoing processes become disabled by the release of all upper manual keys or the turning off of the Repeat Tibia switch.

After the Tibia signal passes through the Tibia photocoupler, it enters IC2 at pins 1, 5, and 12. IC2 is a MOS 4007 connected as a single-pole-double-throw switch. With the Leslie on Tibias switch in the "OFF" position, the Tibia signal travels through the IC, exits at pins 4 and 11, mixes at the Main Channel Amplifier Q1, Q2, and Q5, and enters the Main Power Amplifier Board 124-000487. With the Leslie on Tibias switch in the "ON" position, IC2 switches and applies the Tibia signal to pins 2 and 9, feeding the Leslie channel amplifiers Q3, Q4, Q7, and Q8. The crossover high and low pass filters assure that only frequencies above 200HZ reach transistor Q8 and enter the Leslie Power Amplifier, whereas the frequencies below 200HZ branch out through Q6 and enter the Main Channel Amplifier Q5.

IC's 3 and 4 are MOS 4066 and are wired as double-pole-single-throw switches. IC3 is controlled by the volume soft switch (affecting the Main and Leslie Channels by R13 and R49 respectively) as well as the brilliance switch (affecting the Main and Leslie Channels by R15 and R51 respectively). IC4 is controlled by the expression kick switch which, when used, shunts out the Main and Leslie Channels by R21-C13 and R56-C31 respectively. (NOTE: On later models the kick switch functions the same as the rhythm silent/sound switch).

BRIGHTS

As stated previously the bright voices utilize the 16' and 8' staircase signals from the Generator Board. After voice selection of the upper bright stops and subsequent filtering, the composite signal is mixed and amplified by transistor Q3. Analog gate IC1B serves as an electronic accent control which, when used, bypasses R37. Following accent control the bright signal drives common emitter amplifier Q4, receives level adjustment by R42, and enters analog gate sections IC1C and IC1D.

Together IC1C and IC1D constitute a single-throw-double pole switch. Normally, the bright signals pass through the low impedance of IC1C and drive mixer-amplifier stage Q6 and Q7 with constant amplitude. IC1C is driven to act as a low impedance (closed switch) in the following manner:

1) With the Repeat Main switch (Refer to Endblock Voicing Board) in the "OFF" position, a high impedance to ground exists at J54-6. Because J54-6 of the Endblock Voicing Board is connected to J57 pin 3 of the Upper Manual and Pedal Tab Board, —14V is available at the junction of R51 and R53.

2) The —14V at the junction of R51 and R52 is wired to the gates of IC1D and IC1A. As a result IC1D and IC1A act as open switches.

3) Because IC1A remains open, the gate of IC1C (pin 6) is held to 0 volts through R52. Hence, IC1C maintains a low impedance (closed switch) state.

If the Repeat On Upper switch is placed in the "ON" position, however, a different sequence of events occurs simultaneously. This is:

1) On the Endblock Board the anode of diode D32 becomes grounded presenting a low impedance path to ground for negative voltage at J54 pin 6 and J57 pin 3 on the Upper Manual and Pedal Tab Board. Moreover, the anodes of D14 and D17 become grounded.

2) With a low impedance existing at J57 pin 3, the junction of R51 and R53 changes to the 0 volt level. This change is transferred to the control inputs of IC1D and IC1A and as a result of these changes, both IC1D and IC1A act as low impedances (closed switches). Consequently, IC1D passes the bright signal from Q4 to the LDR of the instrumental and bright photocoupler, and IC1A sends —14V to the control input of IC1C.

3) As IC1C receives —14V at its control input (pin 6), it develops a high impedance between pins 8 and 9. As a result the audio signal from Q4 cannot travel to Q6 and Q7 via IC1C. Instead, the signal flows through the photocoupler first.

4) (Refer to Endblock Board Schematic). With any upper manual key held down, transistor Q12 conducts and develops —27V across resistor R96. This negative voltage starts the repeat oscillator circuits Q26 (via Q21, Q22, Q23, Q24, and Q25) in a manner similar to that described previously.

5) The repeat pulses feed amplifier stage Q27 and Q28 before receiving time constant control by C65 and R163. The pulsed outputs of the C65 and R163 circuit travel through the low impedance of IC6B before driving Q30 and Q31. NOTE: IC6B acts as a low resistance because of the ground applied to the anode of D14.

6) As Darlington pair Q30 and Q31 receive the repeat pulses from IC6B, the transistors drive the LED portion of the Main's photocoupler via J52 pin 20 and J57 pin 11. Thus, the LED is pulsed on and off at the repeat rate. NOTE: The result of the foregoing processes is the modulation of the bright signals by repeat pulses at the

photocoupler. The bright signals, within the repeat envelopes, exit the photocoupler and enter mixer amplifier stage Q6 and Q7 before leaving the Upper Manual and Pedal Tab Board at J57 pin 15.

After leaving the Upper Manual and Pedal Tab Board at J57 pin 15, the bright signals enter the Endblock Board at J54 pin 20. Upon entering the board, the signals travel directly into IC1. IC1, like IC2, is wired as a single-pole-double-throw switch. Normally, the bright signal flows through the low resistance "B" segment of the IC and feeds the Main Channel Amplifier stages. When the Leslie on Main switch is placed "ON" however, the IC switches the signal to the Leslie amplifier stages.

SYSTEM 2 INSTRUMENTAL VOICES

The upper instrument section of 126100 consists of five 16' voices: Cello, Accordion, Harpsichord, Banjo, and Piano. The attack and decay characteristics associated with each of these voices are as follows:

Cello - Slow attack and fast decay. (decay when key is released)
Accordion - Slow attack and fast decay.
Banjo - Fast attack and slow decay.
Harpsichord - Fast attack and slow decay.
Piano - Fast attack and slow decay.

When the voices are used in combination, the fast attack and slow decay characteristic always overrides the slow attack and fast decay. Also, when repeat on upper is used, all selected voices repeat.

All instrumental voices begin as a 16' staircase waveform leaving the Generator Board at J18 pin 6 and entering the Upper Manual and Pedal Tab Board at J56 pin 7. The signal remains constant in amplitude as long as an upper manual key is held down. On the Upper Manual and Pedal Tab Board the 16' staircase directly connects to J56 pin 8, leaves the board, and enters the Lower Manual and Instrumental Tab Board (124-000505) at J59 pin 20.

After entering the Lower Manual and Instrumental Tab Board the 16' staircase drives amplifier Q1 and buffer Q2. Transistor Q2 passes the signal to the Cello stop and to the bilateral switches IC1A, IC1B, IC1C, and IC1D. The activation of the Cello stop passes the staircase to the Cello filter; the selection of the Accordion, Harpsichord, Banjo, or Piano closes a section of IC1 which, in turn, allows the staircase to pass to the proper filter network. After filtering all instrumental signals feed transistor Q4. Transistor Q4 amplifies the signals (R48 provides level adjustment) and sends them out of the board at J59 pin 14.

After leaving the Lower Manual and Instrumental Tab Board the filtered instrumental signals flow back into the Upper Manual and Pedal Tab Board at J57 pin 5. The signals then travel through R46 and enter the LDR portion of the "mains" photocoupler. By the action of the photocoupler, the signals acquire the appropriate attack and decay characteristics.

As stated previously, the LED portion of the "mains" photocoupler receives drive from transistors Q30 and Q31 on the Endblock Board. This drive consists of either the slow attack-fast decay, fast attack-slow decay, or repeat modulating pulses which are formed by circuits on the Endblock Board.

SLOW ATTACK AND FAST DECAY FOR CELLO AND ACCORDION

Normally, transistors Q30 and Q31 on the Endblock Board receive slow attack drive. When any upper manual key is held down, transistor Q12 conducts and passes negative voltage from its collector to the base of transistor Q15. Accordingly, Q15 turns on and bypasses the base/emitter junction of transistor Q16. This turns Q16 off. Now, with transistor Q16 in cutoff, negative voltage from the collector of transistor Q12 slowly (approximately 600-800 ms) charges capacitor C58 through resistor R108. The slow attack curve developed across C58 is negative going and occurs at an exponential rate. After being developed by C58, the waveform travels through diode D12 and drives transistors Q30 and Q31 which, in turn, drive the LED of the "mains" photocoupler.

When all upper manual keys are released, transistor Q12 shuts off and allows transistor Q15 to turn off as well. Thus, transistor Q16 conducts and quickly discharges C58 through R110 until —6 volts is reached. The rapid discharge of C58 changes the input drive to Q30 and Q31. This change reflects a fast decay drive as it reaches the LED portion of the "mains" photocoupler.

After the Cello or Accordion signals become modulated with the slow attack and fast decay envelope at the photocoupler, the signal enters mixer stage Q6 - Q7 and becomes part of the "main" audio signal.

FAST ATTACK AND SLOW DECAY OF BANJO, HARPSICHORD, AND PIANO

If the Banjo, Harpsichord, or Piano stops are selected, ground potential appears at the percussion control output, J59 pin 12 of the Lower Manual and Instrumental Tab Board. This ground is connected to the Endblock Board at J54 pin 14. Ground potential at J54 pin 14 accomplishes two main operations:

1) To shunt the slow attack and fast decay drive from transistors Q30 and Q31 via diode D10.

2) To turn off transistor Q29 and allow the fast attack slow decay drive to reach transistors Q30 and Q31.

The generation of the fast attack and slow decay drive begins on the Endblock Board with legato generator circuit Q13 and Q14. When an upper manual key is held down, the current change through J54 pin 16 allows transistor Q14 to produce a 12 ms negative pulse. This pulse feeds inverter transistor Q17. With the Repeat On Main switch in the off position, transistor Q20 conducts and supplies Q17 with

—28V via R119. As a result, Q17 passes the 12 ms pulse to transistors Q18 and Q19 and their associated components. By the action of D7, R126, R127, C61, and R128 the brief 12 ms signal becomes lengthened to approximately 3 seconds and shaped to a fast attack and slow decay form. The signal then drives transistors Q30 and Q31 which pass the signal on to the main photocoupler for the modulation of the Banjo, Harpsichord, or Piano signals.

When the Repeat On Main switch is selected, transistors Q30 and Q31 receive repeat drive from transistors Q21 through Q28 and IC6D in a manner as described previously. The activation of the repeat switch also shunts the slow attack-fast decay and fast attack-slow decay signals from transistors Q30 and Q31. This shunting (inhibiting) action is accomplished by the grounding of the anodes of diodes D8 and D9 by the repeat switch.

SUSTAIN

All upper manual voices will sustain when the sustain switch is placed in its "ON" position. With sustain on transistor Q9 on the Endblock Board turns off and develops a high collector/emitter resistance. Consequently the collector voltage of transistor Q9 becomes negative and attains a level determined by the position of the wiper arm on the sustain slider potentiometer. The resultant negative collector voltage drives transistor Q10 which, in turn, feeds the sustain control bus on the Generator Board via J54 pin 23 and J19 pin 6.

Hence, with sustain selected a variable negative DC voltage is applied to the anodes of the sustain keyer diodes on the Generator Board. The higher the level of negative voltage applied to the diodes, the longer the keyers sustain.

SYNTHA-ECHO

Closing the Syntha-Echo switch (on the Endblock Board) simulates depressing both Repeat On Mains and Repeat On Tibias. This is accomplished by the action of D16, D15, and D19 in the manner previously described. In addition, Syntha-Echo enables the sustain circuit through D3 and Q11. The closed Syntha-Echo tab also supplies a ground to Q22 base through Diode D18, causing Q22 to turn on. The conduction of Q22 simulates a constant upper manual keydown detection by supplying a level change to transistors Q23 and Q24, thus energizing the PUT (Q26) as long as Syntha-Echo remains on.

In essence, therefore, the Syntha-Echo function combines the characteristics of repeat and long sustain for all instrumental voices.

SYSTEM 3 LOWER MANUAL VOICING - NON AUTOCHORD, AND AUTOCHORD MODES

Like the upper manual voices, the generation of the lower manual tones begins on the Generator Board with the MDD top octave signals and the four 429 LSI Divider Keyer packages. With the application of negative DC keying inputs at J10, J11, and J12 from the Lower Manual keyboard an 8' staircase signal is emitted from the appropriate 429 IC at pin 3. This signal receives amplification by bus amp Q6 and leaves the Generator Board at J18 pin 15. Upon leaving J18 pin 15, the 8' staircase enters the Lower Manual and Instrumental Tab Board at J59 pin 5. From this point, the signal flows to the LDR segment of the lower manual photocoupler for modulation.

On the Lower Manual and Instrumental Tab Board transistors Q7 and Q8 provide the LED portion of the lower manual photocoupler with a continuous DC or pulsed (autochord) drive. Accordingly, the photocoupler modulates the 8' staircase as a continuous or chopped audio.

The source of drive for transistors Q7 and Q8 is the rhythm unit. In continuous mode (non-autochord) transistor Q8 on the rhythm unit is held off by the ground from the autochord switch. With Q8 off, —14V from its collector keeps transistor Q5 in saturation grounding the anode of D15 and one side of resistor R19. Thus, Q4 shuts off and allows the voltage divider R13-R19 to develop —20V at the collector output J30 pin 3. If the rhythm unit is on and set for autochord, transistor Q8 turns on and transistor Q5 turns off. The turn off of Q5 removes ground from the anode of D15, and Q4 turns on dropping its collector voltage to 0 volts. Now, when the chord output (pin 39) of the 433 rhythm IC emits positive pulses, Q4 inverts and amplifies them to 28V peak to peak levels. NOTE: the frequency of these chord pulses is determined by the rhythm rate and the particular rhythm pattern selected.

In either mode, continuous or autochord, the chord gate output at J30 pin 3 is sent into the Darlington driver stage Q7-Q8 before modulating the 8' staircase at the photocoupler. After modulation the lower manual signal travels through the accent network and drives amplifier Q5. Following Q5, the signal reaches the lower manual voicing stops.

Upon selection of a lower stop, the 8' staircase travels through the stop switch contacts and enters a Flute, String, or Horn filter. The filters transform the staircase into the appropriate waveform and pass that waveform to amplifier Q6. Transistor Q6 amplifies, re-inverts, and releases the signal from the Lower Manual and Instrumental Tab Board at J59 pin 8. From J59 pin 8 the signal flows to J57 pin 7 of the Upper Manual and Pedal Tab Board to mix with the main signals at tghe Q6-Q7 amplifier stage.

ONE FINGER CHORDS (NOTE: IN THIS TEXT LOGIC 0 EQUALS —14V AND LOGIC l EQUALS 0V

When activated (pressed down), the tab labeled One Finger Chords converts 20 notes of the lower manual to 20 One Finger Chords. This feature enables one to play full three-note accompaniment chords and corresponding pedals using one finger of the left hand.

Each specific chord is programmed by the chord key which is adjacent to the chord symbol. For example, if the C chord key is pressed, a C lower manual chord and C pedal note will sound.

When the One Finger Chord switch is pushed to its "ON" position, J42 pin 7 of the Ease of Play Board changes from a logic 1 to a logic 0. This change is transferred through resistor R16 to IC13 pin 31, IC6C pin 12, and IC4B pin 6.

The logic change at pin 31 of IC13 sets the 434 IC (IC13) to One Finger Chord mode. As a result when any lower manual key in the C8 - G27 range is depressed, the IC will:

1) Receive a legato loading pulse from Q2 which allows the DC keying data to be accepted as valid inputs.

2) Receive and process each DC keying input from the bidirectional bus (P46 pins 3 through 22). This input comes from a keying circuit on the Generator Board.

3) "Recognize" the single DC input and then send appropriate DC voltages back through the bidirectional bus to the selected keying circuits of the 429 system. These inputs and outputs key the lower manual chords to correspond to the following chart:

ONE FINGER ACTIVATION CHART

I/O Activated On IC-13	Key - #	Chord Name	I/O Activated On IC13	Chord Make-up
1	C - 8	C Maj.	5, 8	C, E, G
2	D^b - 9	D^b Maj.	6, 9	D^b, F, A^b
3	D - 10	D Maj.	7,10	D, F#, A
4	E^b - 11	E# Maj.	8,11	E^b, G, B^b
5	E - 12	E Maj.	9,12	E, A^b, B
6	F - 13	F Maj.	10, 13	E, A^b, B^b
7	F# - 14	F# Maj.	11, 14	F#, B^b, D^b
8	G - 15	G Maj.	12, 15	G, B, D
9	A^b - 16	A^b Maj.	13, 16	A^b, C, E^b
10	A - 17	A Maj.	14, 17	A, D^b, E
11	B^b - 18	B^b Maj.	15, 18	B^b, D, F
12	B - 19	B Maj.	16, 19	B, E^b, F#
13	C - 20	A Min.	10, 17	C, A, E
14	D^b - 21	B^b Min.	11, 18	D^b, B^b, F
15	D - 22	D Min.	3, 6, 10	D, D, F, A
16	E^b - 23	C Min.	13, 20	E^b, C, G
17	E - 24	E Min.	5, 8, 12	E, E, G, B
18	F - 25	F Min.	6, 9, 13	F, F, A^b, C
19	F# - 26	F# Dim.	7, 10, 13, 16	F#, F#, A, C, E^b
20	G - 27	G Min.	8, 11, 15	G, G, B^b, D

After the additional DC inputs feed back to the Generator Board and key the appropriate chord, the composite output signal enters bus amplifier Q6 and follows the same route as described previously.

In addition to keying extra lower manual notes, IC13 on the Ease of Play Board begins the generation of the appropriate bass tone. This process will be described under System IV-Bass.

SYSTEM 4 BASS

BASS WITH ONE FINGER CHORDS

As stated above, the formulation of bass tones in the One Finger Chord mode begins with the application of a DC keying input to IC13 via the bi-directional keying bus. Because IC13 pin 31 is held to logic 0 with the One Finger Chord switch on, the DC keying input to the chip allows these two following operations to occur:

1) IC13 generates a five bit root pedal note code for the selected One Finger Chord and transmits that code serially from its pin 40 to pin 29 of IC12. The serial data is also applied to shift register IC10A and IC10B via IC11C.

2) IC13 generates a 15 micro second enable pulse at pin 2. This pulse is sent to pin 5 of IC12 and allows that IC to accept the five bit data.

Also, in One Finger Chord mode, the logic 0 level at IC6C pin 12, forces IC6 pin 10 to rise to a logic 1. This change allows IC3C to receive a logic 1 input on pin 8. Now, either (or both of) the Britefoot or rehearse/perform switches in the off position, IC3D pin 11 and IC3C pin 9 will be held to logic 1. Hence, IC3C pin 10 falls to logic 0. The logic 0 on IC3C pin 10 is transferred to IC12 pin 9. The logic 0 at pin 9 places IC12 in the"Walking" mode which means IC12 can now react to the serial data/enable pulse from IC13 and ignore any DC inputs from the pedals via P45 of the board.

The negative going change at IC3C pin 10 is also applied to IC8D pin 13. IC8D pin 13 receives logic 0 through the inverted IC8B with its input referenced to ground, logic 1. Now, with two logic 0's at its inputs, IC8D forms a logic 1 at pin 11. This level is inverted to a logic 0 by IC8C. The resultant 0 level is sent to the "Second Octave" input of IC12 pin 28. With pin 28 at logic 0, IC12 narrows its operating range and forms a bass note within the lowest bass octave. The bass tones formed for One Finger Chords existing in the second octave keys are folded over from the first octave. Thus, only 13 different bass tones sound in the entire range of 20 One Finger Chord keys.

The logic 0's at IC4B pins 5 and 6 allow IC4B pin 4 to rise to a logic 1; this allows IC2A pin 9 to fall to logic 0. However, the transition at pin 9 does not affect the pin 6 output of IC2B when a lower manual key is depressed. Because lower manual keydown detector Q17 becomes activated during times of lower manual keydown, IC5A receives a logic 0 at its input pin 2. IC5A inverts the negative input to a logic 1. This logic 1 is transferred from pin 3 of IC5A to pin 5 of IC2B. Thus IC2B pin 6 remains at a logic 0. This action prevents IC12 from operating in String Bass mode (Percussion) by holding IC12 pin 10 to a logic 1 level via IC2C pin 10. IC2C pins 12 and 13 remain at a logic 0 from IC1A.

With IC12 in the Walking mode, it acts upon the five bit serial date. Also, because the 15 micro second enable pulse from IC13 accompanies the sequence of data, IC12 "remembers" and converts the data to appropriate 16' and 8' audio staircase waveforms. With String Bass disabled during the time of lower manual keydown, the trigger out (pin 11) of IC12 falls to a constant logic 0 as soon as the five bit byte and the enable pulse reach IC12. This change from logic 1 (ground) to logic 0 activates Q4 and feeds the time constant circuit Q5 and Q6 which keys input pin 14 of IC12. The presence of the negative keyer input allows IC12 to emit the appropriate 16' and 8' bass audio staircase signal from pins 12 and 13 respectively. These two signals exit the Ease of Play Board at J42-3 and J42-2 before entering the Endblock Voicing Board for further processing.

The bass tone quickly decays when the One Finger Chord key is released. This fast decay is accomplished by the following operation:

1) As soon as the One Finger Chord is released, the lower manual keydown detector Q17, turns off and allows IC5A pin 3 to fall back to its original logic 0 level. This change forces IC2B to feel a 000 input state at its three inputs pins 3, 4, and 5.

2) IC2B pin 6 rises to logic 1 and forces IC2C pin 10 to fall to a logic 0. The negative transition at IC2C pin 10 is felt at IC12 pin 10. Now IC12 is set for String Bass. As a result, the trigger output of IC12 pin 11 remains at logic 0 for 20 MS, but then rises to logic 1.

3) The rise to the logic 1 (ground) level at pin 11 turns off transistor Q4.

4) C6 quickly discharges through R30 and Q6 removing the negative keyer input voltage from IC12 almost immediately. The quick removal of this negative voltage shuts off the keyers in IC12 stopping the release of the 16' and 8' staircase signals.

BASS WITH PEDAL

A standard high select pedal mode is obtainable when IC12 receives a logic 1 at pin 9 from IC3C pin 10. This logic 1 allows IC12 to respond to the negative DC from the pedal inputs and to ignore the serial/enable bass data inputs from IC13.

The depression of any selected pedal (1 through 13) feeds IC12 with a negative DC input (—14V, logic 0) at the appropriate input pin. This input allows the derivation of the appropriate 16' and 8' bass staircase waves, and the release of a negative DC trigger output voltage from IC12 pin 11 to the base of transistor Q4.

With Q19 in conduction and a pedal depressed, Q4 is biased to send approximately —19V from its emitter to the keyer input (pin 14) of IC12. This keyer input allows the continual release of the appropriate 16' and 8' staircase signals from pins 12 and 13 of IC12 until the pedal is released. These two bass signals leave the board at J42-3 and J42-2 for further processing.

If pedal sustain is not selected, the pin 11 IC1D output (logic 0, —14V) turns on Q6. As a result when a pedal is released, the trigger output, pin 11 of IC12, immediately rises to a logic 1 (ground) turning Q4 off. Capacitor C6 discharges rapidly through the low resistance path of R30 and Q6 in parallel with R24. This action rapidly removes the negative keying voltage to IC12 turning off the 16' and 8' pedal signal outputs.

If pedal sustain is selected, J42 pin 5 is held at the logic 0 level. The level forces IC1D to emit a logic 1 (ground) at its output pin 11. This change cuts transistor Q6 off. Now, when a pedal is released, capacitor C6 discharges through R24 allowing a .8 second sustain envelope to appear at the IC12 pin 14 keyer input. As a result the 16' and 8' bass staircase signals will be modulated by the .8 second decaying envelope after pedal release.

BASS AND BRITEFOOT

Britefoot is a unique educational feature that visually indicates the correct pedals to play. When one plays a One Finger Chord or any three or four note chord, an indicator light goes on above the correct root or root and fifth (with rhythm on) pedals for that chord.

When the Britefoot tab is pressed to its "on" position, P42-9 on the Ease of Play Board falls to logic 0 level. This logic 0 level is applied to the following points:

1) To IC8D pin 12, IC13 pin 39, and IC5B pin 6 (via D11 and R93).

2) To IC5D pin 13

3) To IC6C pin 11

4) To IC4A pin 2

5) To IC11D pins 12 and 13

6) To IC8B pin 15

As soon as IC8D receives the logic 0 at pin 12, it forces a logic 1 at its output pin 11. This logic level is inverted by IC8C to a logic 0 which is wired to the second octave input (pin 28) of IC12. Now, the second octave frequences within IC12 become inhibited. Also, as the logic 0 reaches pin 39 of IC13, IC13 automatically becomes set for Bass Swing (Root-Fifth) operation. Finally, as logic 0 reaches IC5B pin 6, the lower manual reset becomes disabled. In summary, the application of logic 0 to these three major points forces Bass Swing operation, inhibits the generation of second octave bass tones, and inhibits the lower manual keydown reset.

Also with Britefoot activated, IC6C pin 11 falls to logic 0 and IC3D pin 13 rises to logic 1 (via inverter IC5D). These two transitions combine to change the pin 8 and 9 inputs of IC3C to 1-1 levels respectively. This induces the output of IC3C pin 10 to fall to logic 0. Accordingly, the developed logic 0 sets IC12 to Walk mode and contributes IC8D maintaining a logic 1 level at its pin 11.

The Britefoot tab also places IC4B pin 5 to a logic 1 level (via IC5D) and IC4A pin 1 to a logic 0 level. These two transitions allow IC4B to maintain pins 1 and 2 of IC2A at logic 0 but force IC4A to hold IC2A pin 8 at logic 1. As a result of the 0-0-1 inputs at pins 1, 2, and 8 respectively, IC2A pin 9 falls to a logic 0. The transition at pin 9 places pin 3 of IC2B at logic 0. Pin 6 of IC2B, however, does not rise to logic 1 because the lower manual keydown signal via IC5A forces pin 5 of IC2B to rise to logic 1. As a result of these actions IC2C pin 11 holds to logic 0. IC2C pins 12 and 13 are at logic 0 if the autochord switch is off. This level change allows IC2C pin 10

to hold a logic 1 level keeping IC12 out of String Bass mode. Thus, all bass tones will be non-percussive.

Finally, with Britefoot "on" inverter IC11D receives logic 0 at its input pins 12 and 13. Because IC11D inverts the logic 0 input to a logic 1 output transistor Q16 conducts and turns on the green Britefoot LED located above the pedal clavier. The application of logic 0 to the $\overline{E}$ input of IC9B enables one of four line decoders to select one of four LED's from an activated chain of LED's on the Britefoot Board.

In Britefoot mode, the enable pulse from IC13 and the 60 KHZ time bass clock from IC12 are intercepted by IC11B. The IC passes and inverts the clock for the duration of each enable pulse. IC11A reinverts the clock train and applies it to the "C" inputs of shift registers IC10A and IC10B. At the same time, the five bit byte of serial bass data is intercepted and inverted by IC11C. This data is then applied to the "D" input (pin 7) of the shift register, IC10A. The clock pulses cause the inverted serial data to be loaded into the shift register. Thus, the shift register converts the serial data into parallel data.

IC10 pin 13 contains the least significant bit and IC10 pin 5 contains the most significant bit. The two least significant bits at IC9B pins 14 and 13 select which of four LED cathode chains are to be activated. The third and fourth bits at IC9A pins 2 and 3 select which of three LED anode chains are to be activated. The selection of one cathode and one anode chain allows the appropriate LED to glow.

If Britefoot alone is activated, IC12 works in the same mode as One Finger Chords. IC12 pin 9 is held to a logic 1 allowing the receipt of serial bass data. String Bass is inhibited by the inverted keydown signal from IC5A which travels and holds pin 5 of IC2B to logic 1. IC2B, therefore, ignores the level change at pin 3 and holds pin 11 of IC2C to logic 0. As a result, IC2C pin 10 maintains a constant logic 1 level until all lower manual keys are released.

When One Finger chords are activated, system performance remains the same except the bass calculations within IC13 include One Finger Chords instead of straight lower manual information.

With Walking Bass activated the logic 0 on IC8B pin 4 rises to a logic 1. Root/Fifth operation is forced via D11 and the Britefoot switch in the "ON" position. The system maintains performance as described previously.

BRITEFOOT REHEARSE/PERFORM

This tab enables one to use the Britefoot feature in two ways:

1) In the Rehearse position, the Britefoot lights indicate the pedals that are playing automatically.

2) In the Perform position, the Britefoot lights show the correct pedals, however the pedal does not sound - the organist must play the pedal.

In the foregoing explanation of Britefoot we assumed that the rehearse/perform switch was set for rehearse. If the rehearse/perform switch is depressed and therefore set for perform mode, a performance change occurs. In the perform mode P42-8 is changed to a logic 0 level. IC3B inverts the level to a logic 1 and applies that level to IC3D pin 12 and IC4A pin 1. IC3D now receives a logic 1 at both inputs, pins 13 and 12, which forces pin 11 of the IC to drop to logic 0. Now, IC3C receives a logic 1 at pin 8 and a logic 0 at pin 9. This combination of inputs maintains the pin 10 output of IC3C at logic 1 which holds IC12 in pedal mode. Therefore, although IC13 continues to send bass note information to the Britefoot display, IC12 ignores this information. The bass audio is only obtainable by the action of the standard pedal inputs to IC12.

BASS SWING/BASS WALK MUSICAL PERFORMANCE

The Bass Swing/Bass Walk feature works in conjunction with the rhythm buttons to create bass patterns. This feature may be used with both One Finger Chords or three and four note chords played on the lower manual within the One Finger Chord range.

With this rocker tab in the flat position (Bass Swing), one hears root and fifth pedals with each selected rhythm pattern. The root pedal is the chord name while the fifth tone is the harmonic alternate tone of that chord.

When the tab is pressed forward, Bass Walk is activated. This effect works with Western, Ballad, Jazz, Rock and Latin Rhythm or when no rhythm has a pre-programmed complementary Bass Walk pattern. Also, the sequence of bass notes varies with each chord, simulating the playing style used by professional String Bass players.

The automatic bass (Bass Swing or Bass Walk) starts and stops with the rhythm unit. As a result, the pedal pattern continues to play even after the chord is released. This prevents undesirable breaks in the pedal pattern when changing chords and also frees the left hand to play on the upper manual or change registration.

The automatic bass feature programs correct pedal notes for major, minor, seventh, major seventh, minor seventh, and major and minor sixth chords. These chords may be played in any inversion. However, for major sicth and minor seventh chords the following rules should be observed.

1) Major sixth chords - Play the root of the chord as the top or bottom note.

2) Minor seventh chords - Play the root or the seventh on the bottom.

When using Bass Walk, the pedals will "walk up and down" each of the notes of the diminished or augmented chords, and double-notes or non-chord clusters. This feature is particularly useful for creating special "boogie" bass patterns. One may also manually play String Bass solos on the

lower keyboard by simply playing single notes. Note: For the best musical results one should move from one left-hand chord to the next in a detached manner.

BASS SWING/BASS WALK REQUIREMENTS FOR OPERATION

The actuation of both the Silent/Sound and the Autochord switches in the rhythm unit is required for either Bass Swing or Bass Walk. This changes P42 pin 12 (Ease of Play Bus) from logic 0 to logic 1. The actuation of the Silent/Sound also places P42-11 (Pattern enable bus) to logic 0. The level changes at the Ease of Play and the pattern enable buses cause the following immediate changes to occur:

EOP TO LOGIC 1	PATTERN ENABLE TO LOGIC 0
IC7C pin 8 goes to logic 1	IC7A pin 1 goes to logic 0.
IC7B pin 5 goes to logic 1	
IC7A pin 2 goes to logic 1	
IC6A pin 8 receives a logic 1 pulse	
IC3A pin 1 goes to logic 1	
IC1B pin 5 goes to logic 1	
IC2B pin 4 goes to logic 1	

The foregoing changes cause certain subsequent events to occur. These events are:

The logic 1 at IC7B pin 5 and IC7C pin 8 allows the 1/4 note timing signals to pass through IC7B and IC7C to enter IC13 at pin 3, the tempo clock input. These 1/4 note signals assure that the operation of IC13 will always be synchronized with the tempo setting of the Rhythm Unit.

The change of level at IC7A pin 1 from logic 1 does not effect the pin 3 output of IC7A. Only when the Silent/Sound switch is in the "sound" position, the autochord switch is in the "ON" position, and the touch start switch is in the "ON" position (prior to keydown) will the pattern enable and EOP buses maintain logic 1 levels. This allows pin 3 of IC7A to fall to logic 0. As a result of this process IC8A pin 3 (the reset gate output) remains at a constant logic 1 except:

1) When the Ease Of Play Bus changes from logic 0 to logic 1 (rhythm unit off/on transitions), a pulse is formed through P-42-10, IC5C, C8, IC6A, and IC8A to reset IC13.
2) In Bass Walk mode when every detached lower manual keydown forms pulse from Q17, IC5A, IC5B, C10, IC6A, and IC8A which resets IC13.
3) Before keydown when the Silent/Sound and Autochord switches are activated.

NOTE: Whenever the reset input of IC13 goes to a logic 0, the bass data transmission is shut off and the bass pattern timing resets to the beginning of its sequence.

The logic 1 applied to IC2B pin 4 does not effect the IC's pin 6 output. However, the change to logic 1 on IC1B pin 5 does effect the state of IC1B. Now with the logic 1 resting on both of its inputs, IC1B places its output pin 4 at a logic 0. This allows the pin 3 output of IC1A to rise to the logic 1 level which, in turn forces IC2C pin 10 to fall to logic 0. Because pin 10 of IC2C is wired to the String Bass input of IC12 (pin 10), IC12 becomes set for String Bass operation. Thus, the derived bass tones will be keyed by a percussive envelope voltage.

The logic 1 output of IC1A pin 3 also turns off Q19, turns on Q5 via IC1C, and turns off Q6 via IC1D. These changes increase keying of IC13 from —19V to —28V and sets the sustain time constants for sustain.

The change to logic 1 at IC3A pin 1 forces pin 13 of IC6C to fall to logic 0. This allows IC6C pin 10 to rise to the logic 1 level, which is fed to pin 8 of IC3C. Now with two logic 1 inputs, IC3C pin 10 falls to a logic 0 which places IC12 in Walking Bass mode. Thus, IC12 can accept the serial data from IC13 and can reject the DC inputs from the pedal clavier.

BASS SWING CIRCUIT OPERATION

When the Bass Swing/Bass Walk tab is set for the Bass Swing mode (not actuated) P42-14 of the East of Play Board is set at logic 1. IC8B inverts the logic 1 to logic 0, and by way of diode D1 and resistor R93, the logic 0 reaches IC8D pin 12, the root/fifth bus and IC13 pin 39, and IC5B pin 6.

The logic 0 at IC8D pin 12 helps to hold the pin 11 to logic 1 which is inverted by IC8C to maintain the pin 28 input of IC12 at logic 0. This logic 0 assures that IC12 restricts itself and produces first octave bass tones only. Also a logic 0 at pin 39 of IC13 assures alternating root/fifth operation. Finally, the logic 0 at pin 6 of IC5B guarantees that no detached lower manual keydown resets IC13.

In Bass Swing mode IC13 responds to the selected lower manual chord inputs by sending out alternating sequences of enable/serial bass data to IC12. These sequences represent a root/fifth, etc. The actual timing of the root/fifth sequence is determined by the rhythm pattern selected and the rhythm rate.

If IC13 receives lower manual DC inputs which do not make up a recognizable chord, it selects the lowest and highest notes depressed and alternates their respective bass notes.

BASS WALK CIRCUIT OPERATION

When the Bass Swing/Bass Walk tab is pressed and is set for the Bass Walk mode, logic 0 is placed upon P42-14 of the Ease of Play Board. IC8B inverts the negative level to logic 1. The logic 1 from IC8B allows the rhythm patterns and the Britefoot switch determine the levels of IC8D pin 12, IC13 pin 39, and IC5B pin 6. Therefore, when no rhythm pattern select buttons are pressed in or when Western, Ballad, Jazz, or Rock are selected, IC8D pin 12, IC13 pin 39, and IC5B pin 6 rest at a logic 1 from the resistive network RN5. If the Latin, March, or Waltz patterns and/or Britefoot are selected, the foregoing pins fall to logic 0.

At IC8D a logic 1 on pin 12 combines with the logic 0 on pin 13 forcing pin 11 to fall to logic 0. IC8C inverts the logic 0 to a logic 1 which allows logic 1 through R94 to appear at pin 28 of IC12. Now, IC12 can generate bass patterns which extend into the second octave if the serial data sent by IC13 directs it to do so. If IC8D pin 12 falls to logic 0, IC8D and IC8C hold pin 28 of IC12 to logic 0. This level restricts IC12 and allows it to produce only first octave bass tones.

With logic 1 placed upon pin 39 of IC13, the IC is removed from root/fifth mode and placed in Bass Walk mode and with logic 1 at IC5B pin 6, any detached lower manual keydown will cause resetting of IC13.

Now, if IC13 recognizes the lower manual keying inputs (on the bi-directional bus) as chords, the chip sends out enable/serial data in one of twelve possible sequences. These sequences are termed:

M with three variations
W with three variations
S with three variations
BAT with three variations.

Although only four bass pattern families exist, three variations of each family can be called on. Hence, one of twelve possible patterns can be used. The determining factor of which family is called on is the structure of the chord played. The following chart associates the M, W, and S bass families with the chords which activate them.

PATTERN FAMILY	L/M CHORDS WHICH ACTIVATE THE FAMILY
M	Major or Major 7th or Major 6th
W	Minor or Minor 6th or Minor 7th
S	7th

In the 125100 series the BAT family is called on only when the Latin pattern is selected. Therefore, no matter which chord is played in the Latin pattern, the BAT family is used.

In all four families the determining factor of which variation is called on is the key of the chord selected. This corresponds to the following chart:

- All C#, D, and D# chords use variation 1
- All E, F, F#, and G chords use variation 2
- All G7, A, A# and B chords use variation 3

An exception to the rule exists in Walking Bass mode if IC13 receives lower manual keying input clusters that form an unrecognizable chord, the following bass patterns are formed:

		TIME			
		Measure 1	Measure 2	Measure 3 same as 1	Measure 4 same as 2
UNRECOGNIZABLE CHORDS	1 keying input	1-1-1-1-1-1-1-1			
	2 keying inputs	1-2-1-2-1-2-1-2			
	3 keying inputs	1-2-3-1-2-1-3-2			
	4 keying inputs	1-2-3-4-1-4-3-2			
	5 keying inputs	1-2-3-4-5-4-3-2			

SYSTEM 5 RHYTHM UNIT

GENERAL INFORMATION

Rhythm Unit 124-000485 is used in the 125100 series organ to provide 7 rhythm patterns and 4 variations of each pattern. The unit also supplies timing outputs (1/4 measure, 2 measure, Pattern Enable) to the Ease of Play Board. The unit also supplies control outputs to the Endblock Voicing Board for gating of the lower manual tones.

The Auto Vari functions in any one of 2 basic modes - continuous and touch. Also the Auto Vari and Autochord features work in conjunction with either of these two. The unit operates in the "continuous" mode with any rhythm pattern switch(es) pressed in, with the Silent/Sound switch resting in the "Sound position, and the Touch switch resting in the "OFF" position. No manual or pedal key need be held down for this mode. The unit functions in the "Touch" mode when a rhythm pattern is selected with the Silent/Sound switch placed in the Sound position with the Touch switch on, and with a lower manual or pedal key depressed. As soon as the keys are released, the unit stops running.

THE RHYTHM IC 075-000433

The rhythm chip IC1 provides the properly timed pulse outputs for 1) the triggering of the instrument generators within the rhythm unit 2) triggering in the chord, root, third, and fifth gates (only the chord is used in the 126100) 3) triggering the tempo LED and, 4) triggering the variation lamps. The IC releases pulses only when it receives all required enabling inputs. These inputs are:

1) Clock - at pin 21
2) Pattern Selection - at pins 2 and 4 through 9.
3) AY2 and Y3 0 Code - at pins 18 and 19.
4) —14DC - at pin 40.
5) Ground - at pins 1, 3, and 10 through 17.

When all required inputs are applied to the IC, the following outputs result:

1) Properly timed —14 volt pulses for Claves, Conga, Bongo, Snare, Brush, Cymbal and Bass Drum.
2) Properly timed pulses for Chord, Root, Fifth and Third.
3) Regularly timed pulses occurring once every two measures that can clock IC2 in Auto Vari Mode.
4) X2 and X3 pulses which drive the tempo LED and run bass patterns which occur only on multiples of 1/2 beats (1/8 measure).

RHYTHM CLOCK GENERATOR

A programmable unijunction transistor oscillator, consisting of Q6 and its associated circuitry is used to provide the clock pulses for the IC1 rhythm chip. Q6 is a continuously running relaxation oscillator. During the nonconduction time of the PUT, the gate is held at —4 volts, by the voltage divider

R26-28. The cathode is held to —14V, and the anode continuously rises in level by the charging of C2 through R24 and the rhythm rate potentiometer. As soon as the anode reaches a level of +3.5 volts the PUT turns on and acts as a low resistance element cathode to anode. Accordingly, C2 discharges through R23 almost immediately. This quickly turns off the PUT. C2 then begins charging through R24 and the rhythm rate pot to start the cycle over.

The spike pulses developed by R23 during the conduction of Q6 turn on transistor Q7. Q7 amplifies and inverts the pulses before sending them to the clock input (pin 21) of IC1 via R30.

STARTING THE RHYTHM UNIT

The Silent/Sound and the Touch Start are controlled by gates in IC4C and IC4A. IC4C and IC4A are connected as a memory flip-flop with the Touch switch in the feedback path.

In the continuous mode of operation IC4A pin 1 is held to a logic 1 through R151 and the Touch Switch. The logic 1 at pin 1 allows IC4A to act as an inverter for the Silent/Sound switch causing the pattern enable line to go to —14 volts (logic 0) when the switch is in the Sound position and 0 volts (logic 1) when the switch is in the Silent position.

In the Touch Start mode of operation IC4C becomes connected to IC4A via the Touch switch. Now with the Silent/Sound switch in the Sound position, IC4C is held to logic 1 (ground), and with no keys down IC4C pin 8 is held to logic 1 (ground) as well. When a key down input arrives, IC4C pin 8 is pulled to logic 0 (—14V) causing IC4C pin 10 to rise to the logic 1 (ground) level. The positive transition at pin 10 is coupled through the Touch switch and R151 to place pin 1 of IC4A to the logic 1 level. Now, with IC4A receiving logic 1's at both inputs, its output (pin 3) falls to logic 0 (—14V). The —14V at pin 3 enables the pattern line and present feedback to IC4C pin 9. The feedback at pin 9 forces the flip-flop to maintain this state even after keydown information is removed.

Every time the pattern enable line switches to —14V, the pattern selector switches can set IC1 to the appropriate pattern. Also, every transition from logic 1 to logic 0 is differentiated by C6 and R49 and applied through D21 to the reset input of IC1 pin 20. This pulse is also inverted by IC4B and connected to the Auto Vari switch. When Auto Vari is selected, the inverted pulse resets IC1 to variation A, measure 1 and beat 1.

AUTO VARI

The Auto Vari switch has two functions. One is to connect or disconnect the reset line from the 4013 IC. This function assures that keydown and Silent/Sound information will reset the 4013 IC to variation A only when Auto Vari is selected. The second function of the switch is to send the two measure square waves to the clock inputs of IC2 (when Auto Vari is on) or to present a solid —14V to the clock inputs when Auto Vari is off.

By connecting the clock input of IC2 to the two measure line, the square wave outputs of IC1, occurring once every two measures, are transferred to the clock inputs of IC2 pin 3. IC2, the 4013 chip, is connected as two cascaded divide-by-two counters which release a binary code to the Y2 and Y3 (pins 18 and 19) inputs of IC1. IC2 also triggers the variation lamp drivers Q15 and Q16. The data sent to the Y2 and Y3 inputs program IC1 for the appropriate variation of A, B, C, or D. The data sent to the lamp drivers determine which lamp should light, at any particular time. All four drivers are connected as "AND" gates which require —14V levels (binary 0's) on their base inputs for conduction.

The rate at which the Auto Vari feature sequentially changes variation is determined by the rhythm rate. As a resistance change of the rhythm rate pot changes the rate at which IC1 receives clock pulses, the measure outputs of IC1 change rate. These outputs now clock IC2 at a different rate. As a result the Y2 - Y3 inputs of IC1 and the lamp driver gates receive the binary data from IC2 within a different amount of time.

TEMPO LAMP

When the rhythm is off, the X3 pulses from IC1 (pin 23) trigger Q13 and Q14 at a 1/4 measure rate. As Q13 and Q14 conduct the tempo LED glows. The X3 pulses reach Q12 and Q14 through R57, D24, C8, and R64. Also, at this time D23 is held in reverse bias by the conduction of Q12. Transistor Q12 conducts because the rhythm pattern switches receive 0 volts from pin 3 of IC4A.

When the rhythm is on, however, IC4A applies —14V to the rhythm pattern switches. This voltage turns off Q12 through R59 and reverse biases D24 through D22. Now the one measure output (pin 25) of IC1 triggers the tempo lamp drivers at a one measure rate. The one measure output reaches Q12 and Q14 through R58, D23, C8, and R64.

VOICE GENERATORS

The Rhythm voice generator section of the rhythm unit is composed of five phase shift oscillators (Q19, Q22, Q23, Q24) and two white noise gates (Q20 and Q21).

Each of the low frequency phase shift oscillators is biased slightly off. The positive pulses from the 433 IC are differentiated and shaped to the proper amplitude and decay characteristics by a diode and RC circuit. The pulses are then applied to the bases of the oscillator transistors. The trigger pulses cause the stage to "ring" at a frequency determined by the RC feedback from collector to base. The resultant output signals are coupled from each collector to the mixing junction R105 and J26-1.

The white noise gates Q20 and Q21 are supplied with a low level white noise signal from IC3. The pulses from the 433 IC are differentiated and shaped before triggering the transistors. During the triggering time period, the gating transistors turn on and amplify the white noise.

Q21 has an LC resonant collector load shared by the Brush and Cymbal; Q20 has a low pass characteristic used for the Snare high frequency component. These signals are also fed into the mixing junction. The output signal is capacitively coupled to the volume pot via C60.

THE CHORD GATE NORMAL AND AUTOCHORD

With the Autochord switch in the off position the base of Q8 is held at ground potential. The ground keeps Q8 cutoff which, in turn, keeps Q5 on. The conduction of Q5 moves forward bias voltage from Q4 via D15. As a result of this circuit operation, the "Chord" output of the rhythm unit rests at —20V with Autochord off. (The R13, D16, R19 voltage divider increases the Q4 collector voltage by 8V).

If the Autochord switch is placed in the "ON" position while the rhythm unit is running, Q8 becomes forward biased by the —14V from the Silent/Sound switch. When Q8 conducts, Q5 shuts off and allows Q4 to conduct. IC1 supplies Q4 with properly timed pulses by way of differentiator C1, R16, R17, and D14. This operation results in the pulsating of Q4's collector voltage from 0V to —28 volts. This output "chops" the chord gate Q4 and Q5 in the Endblock Voicing Board.

SYSTEM 6 SOUND SIMULATOR I

INPUT SWITCHING CIRCUITS

The selection of input pitch and waveform is controlled by IC1 and IC3. These IC's contain analog gates which are controlled by the voice selection diode matrix. The inputs that can be selected are 16', 8', and 2' stairsteps, and 16' square wave.

As an example, when the Trombone button is depressed, a ground is applied to P61-8. This ground, through D7, turns on the "A" section of IC1, allowing the 16' stairstep signal applied to pin 1 to pass to pin 2, and then on through C2 and R2 to the VCF.

PRE-FILTER CIRCUITS

The selected inputs are routed into pre-filters when the Cornet, Clarinet, or Saxophone are selected. The Coronet and Clarinet share one pre-filter, the other is for Saxophone. The Saxophone voice also contains 16' stairstep signals which bypass the Saxophone pre-filter. The two pre-filters mix with the other voices before entering the VCF.

The Cornet/Clarinet pre-filter consists of Q1 through Q3 and associated discrete components. Q1 is a buffer to provide a low impedance drive to the filter stages. Q2 is a bandpass filter with a peak at approximately 1800 HZ and a roughly 12db/octave rolloff above and below the peak. Q3 corrects the phase relationship of the total filter to match the phase of other signals entering the VCF.

The Saxophone filter consists of Q4 and Q5 and associated discrete components. The output of the filters combines with straight stairsteps bypassing the filter to give a net response characterized primarily by an 18db dip at approximately 555 HZ, which attenuates the fundamental component of the stairstep but does little to the upper harmonics.

VCF (VOLTAGE CONTROLLED FILTER)

Signals from the input switching and pre-filter stages are amplified by Q6 and buffered by Q7. The low impedance output from the emitter of Q7 drives the LDR portion of the LED/LDR assembly. Varying the light output of the LED changes the resistance of the two matched sections of the LDR. The time constants of the LDR sections in combination with C17 and C18 determine the cutoff frequency of the VCF.

Q8 and Q9 buffer the signal to prevent loading of the filter sections. IC2 is an op amp which provides a voltage gain regulated by the feedback from pin 6 to pin 2. In addition, pin 6 provides positive feedback to C18.

The filter operates as a low-pass filter when R50 is shunted across R51 and R52 by one of the sections of IC3. This mode is used for five of the voices, which control IC3 through D12 through D16. When the voice selected is not one of these five, the gain of IC1 is increased and the feedback becomes sufficient to change the filter to a band-pass response, with signal attenuation below cutoff as well as above. The resonance causing the band-pass response is the result of the strong positive feedback through C18, and is controlled by R52, the resonance control.

In the low-pass mode, the gain of the VCF at the cutoff frequency is lower than it is in the band-pass mode. For this reason R54 is shunted across R53 by a section of IC3 when the low-pass mode is selected.

VCF CONTROL CIRCUIT

The light output of the LED in the LED/LDR assembly is controlled by three sources: a rest voltage, a sweep voltage, and a vibrato voltage.

The rest voltage is the input to the LED that determines the filter cutoff frequency after the filter sweep is completed. The rest voltage is selected by the voice selection diode matrix in much the same way as the pitch inputs are selected. A voltage is selected from the taps in the divider chain R98 through R106 by turning on one of the sections in either IC4 or IC5. The selected voltage is applied to Q11 and then Q10. Q11 mixes the control voltages, and then Q10 acts as a current driver to light the LED. Bias and sweep controls determine the end points of the VCF control range.

The vibrato voltage is gated by one of the sections of IC5 when the Trombone or Novelty voice is selected, and is added by Q11 to the rest voltage. The vibrato voltage sweeps the filter back and forth at vibrato frequency, producing a "wow" type effect.

The sweep voltage is divided by the R119 through R124 divider chain and selected by either one of the gates in IC6 or by Q17 or Q18. The sweep is added in Q11 as described earlier.

The sweep itself is generated from the keydown information from the organ. When a key is depressed, —28V is applied to P51-6. This turns on Q30, which through C34 and D35 turns on Q19. The collector of Q19 goes to ground, turning off Q20. The collector of Q20 now goes to —28V, holding n Q19. This latching action prevents problems caused by key bounce.

The —28V at the collector of Q20 is buffered by Q22 and drives Q23, Q24, and D48. Normally Q23 and Q24 are turned off, so that the —28V from Q22 charges C37 only through D48, R154, and R147. If the Cornet voice is selected, Q24 is turned on and D43 and R150 also charge C37, leading to a faster attack on the sweep. If Pizzicato or Clarinet is selected, Q23 turns on, leading to an even faster attack.

The sweep current is amplified by Q28 and Q29 and from Q29 drives the R119 through R124 divider chain described previously. When the sweep voltage reaches approximately —11V, Q21 turns on, turning on Q20 through R140. This turns off Q19, resetting the latch.

When the latch resets, Q22 turns off. The ground at the collector of Q20 begins discharging C37 through Q26 and R157. If the French Horn voice is selected, Q26 is turned off, and C37 is discharged only through R158, resulting in a very long sweep decay time.

When a key is depressed, Q27 is turned on briefly to discharge C37 to prevent "pumping up" of the sweep in rapid staccato playing.

It should be noted that some voices have no rest voltage, some have no sweep voltage and some have no vibrato voltage present.

VCA (VOLTAGE CONTROLLED AMPLIFIER)

Q15 and Q16 are a differential amplifier with gain dependent on the emitter current through R91. Increasing the current through R91 increases the gain of the amplifier.

Q13 and Q14 are also a differential amplifier, but with fixed gain. R87 is a null control which allows the Q13-Q14 amplifier to remove any DC offsets produced in the Q15-Q16 amplifier during gain transitions. R81 is a main level adjustment.

Q12 is a final gain stage to drive the organ pre-amps.

VCA CONTROL CIRCUITS

When a key is depressed, or if a new additional key is depressed when one or more are already down, a short —28V pulse is applied to P51-3. This pulse turns on Q33 through C39 and D52. The ground at the collector of Q33 turns off Q34, latching Q33 on.

When Q34 turns off, —28V is applied to R174, turning on Q35. If the Trombone voice is on, Q36 is turned off and C42 is charged through R178 and D58. If the Trombone voice is off, Q36 is turned on and C42 charges much faster through R177 and D57.

The voltage across C42 is applied to Q43 and Q44 which provide the current drive to the VCA through R185.

When the voltage across R184 reaches approximately —11V, Q41 turns on, resetting the Q33-Q34 latch.

Q42 discharges C42 when a key is depressed to prevent "pumping up" of the VCA drive voltage in rapid playing.

Q31 and Q32 are a squelch circuit. If no key is depressed, Q31 is off, which turns on Q32, removing any voltage across C42 and turning off the VCA to prevent background noise problems.

If the pizzicato voice is selected, Q39 turns off and Q40 turns on, leading to a percussion envlope because the ground at the collector of Q34 after the latch resets discharges C42 through R193 and D64. The Chirp voice operates similarly to the Pizzicato voice, but with a shorter decay time.

SECTION II
TEST & ADJUSTMENT PROCEDURES

ORGAN TEST AND ADJUSTMENT PROCEDURES

NOTE: ALL TESTS ASSUME MAXIMUM SWELL (EXPRESSION) UNLESS INDICATED OTHERWISE

STEP	TITLE OF TEST	SETUP PROCEDURE (TABS DEPRESSED) (TONEBARS OUT)	KEY (S) DEPRESSED	TEST POINT	POT AND BOARD	SPECIFICATION AND/OR ACCEPTABLE CONDITION
1	a) Main Level b) *Kick Switch	a,b) 8' Tibia	a,b) U/M 8	a,b) Main Speaker	a,b) Main Level R17 124-506	a) 2.2V RMS b) Reduces level to less than min. swell
2	Minimum Swell	8' Tibia	U/M 8	Main Speaker		100-180mV RMS
3	a) Leslie Level b) *Kick Switch	a,b) 8' Tibia Leslie on Tibias	a,b) U/M 8	a,b) Leslie Speaker	a,b) Leslie Speaker	a) 1.4V RMS b) Reduce level to less than min. swell.
4	Bright Level	U/M 8" String U/M Accent	U/M 8	Main Speaker	Bright Level R-42 124-506	.550V RMS
5	U/M Levels	Depress tabs one at a time. a) 16' Tibia b) 16' String c) 8' Diapason d) 8' Horn e) 4' Tibia f) 8' Tibia & accent	a-F) U/M 8	Main Speaker		a) 1.34 - 2.68V RMS b) 0.576 - 1.15V RMS c) 1.21 - 2.42V RMS d) 0.247 - .78V RMS e) 1.27 - 2.54V RMS f) 4 - 8 db Increase
6	Percussion Cutoff	Piano	U/M 8, 12, 15 (Continue to hold keys after sound dies).	Main Speaker	Offset R112 124-504	Adjust offset pot to where waveform on scope just disappears.
7	Percussion Level	Depress tabs one at a time. a) Cello b) Accordion c) Harpsichord d) Banjo e) Piano f) Repeat Upper Banjo g) Repeat Tibias Tibia 8'	a-e) U/M 8 f) U/M 37 g) U/M 8	Main Speaker	a) Perc. Level R48 124-505	a) 0.71V RMS b) 0.33 - 0.65V RMS c) 2.0 - 7.0 V P-P d) 2.2 - 8.2 V P-P e) 4.0 - 11.0V P-P f) 2.2 - 8.2 P-P g) 6.6 - 15.4V P-P

*On late versions of 126100, Kick Switch functions as silent/sound and not mute.

REFER TO DIAGRAM ON LAST PAGE OF THIS SECTION
FOR LOCATION OF POTENTIOMETERS

ORGAN TEST AND ADJUSTMENT PROCEDURES (Continued)

NOTE: ALL TESTS ASSUME MAXIMUM SWELL (EXPRESSION) UNLESS INDICATED OTHERWISE.

STEP	TITLE OF TEST	SETUP PROCEDURE (TABS DEPRESSED) (TONEBARS OUT)	KEY (S) DEPRESSED	TEST POINT	POT AND BOARD	SPECIFICATION AND/OR ACCEPTABLE CONDITION
8	Pedal Level	Depress one at a time a) 8' Flute Pedal Slider-Max. b) 16' Diapason c) Bass Guitar d) 8' Flute Pedal Slider-Min.	a-d) Pedal 1	Main Speaker	a) Pedal Level R90 124-506	a) 2.0V RMS b) 1.41 - 2.83V RMS c) 7.7 - 14.3V P-P d) 0.134 - .268V RMS
9	L/M Levels	Depress L/M tabs one at a time a) 8' Flute b) 8' Flute, Accent c) 8' String Accent "OFF" d) 8' Horn	a-d) U/M 8	Main Speaker	a) L/M Level R59 124-505	a) 1.0V RMS b) 7.5 - 10.5 db Increase c) 0.134 - 0.268V RMS d) 0.084 - 0.266V RMS
10	Vibrato Width	Vibrato On		Collector Q3 124-499	Vib. R260 Width 124-499	5.5 - 6.5V P-P
11	Vibrato Rate	Vibrato on		Collector Q3 124-499	Vib. Late R250 124-499	142 - 152msec
12	Reverb	U/M 16' String 8' String 8' Horn Vibrato On Reverb Pot at max. Leslie on Mains	U/M 32, 33,34 35,36	Main Speaker	Reverb Level R20 124-166	900mV RMS
13	Rhythm Level	Waltz Silent/Sound Variation A Volume at Max.		Main Speaker	Rhythm Level R 7 124-504	11.0V P-P Bass drum amplitude measured on Beat 1
14	Volume Soft & Brilliance	a) U/M Tibia 8' then volume soft b) Same as a) with Leslie on Tibias	a,b) U/M 8	a) Main Speaker b) Leslie Speaker		Compare volume soft level reduction 5-9 db
15	Tuning	8' Tibia	U/M 37	Main Speaker	Coil 124-499	1393 - 1401 HZ
16	Hum and Noise	All U/M Voices All U/M Instrumental Voices All L/M Voices Accent Sustain Sust. Pot at max. Reverb at max. Rhythm Vol. at max. a) Main Channel b) Leslie Channel		a) Main Speaker b) Leslie Speaker		NOTE: Reverse Line cord for lowest reading a) 15mV RMS max. swell b) 15mV RMS max. swell

SOUND SIMULATOR I

TEST AND ADJUSTMENTS

1) **VCF RESPONSE AND ADJUSTMENTS** NOTE: 1) TP4 refers to the junction of C16, R30, R39, R13, and R2 on 124-000503 PWB. 2) TP7 refers to the junction of R32, C21, R54, and R55 on 124-000503 PWB. 3) All test points are referenced to ground.

   A) **PREADJUSTMENTS:** Adjust R59 (sweep width) and R62 (sweep bias) to their center positions. Adjust R52 (resonance) to minimum (counter-clockwise).

   B) **RESONANCE ADJUST I:** Press the chirp button. Rotate R52 (resonance) clockwise until oscillation is observed at TP7. Rotate R52 counter-clockwise until oscillation stops.

   C) **WIDTH ADJUST:** With the chirp button pressed, apply a 11KHz sine wave signal at 15mV (RMS) to TP4. Adjust R59 (sweep width) for peak output at TP7.

   D) **RESONANCE ADJUST II:** With the chirp voice on, apply a 1KHz sine wave signal at 15mV (RMS) to TP4. Note the output level at TP7. Change the input frequency to 11KHz. Adjust R52 (resonance) to give an output level at TP7 that is 12dB higher (4 times the RMS voltages) than the output level at 1KHz.

   E) **BIAS ADJUST:** Press off the chirp voice. Press on the Pizzacato voice. Apply a 150 Hz sine wave signal at 15mV (RMS) to TP4. Adjust R62 (sweep bias) for peak output at TP7.

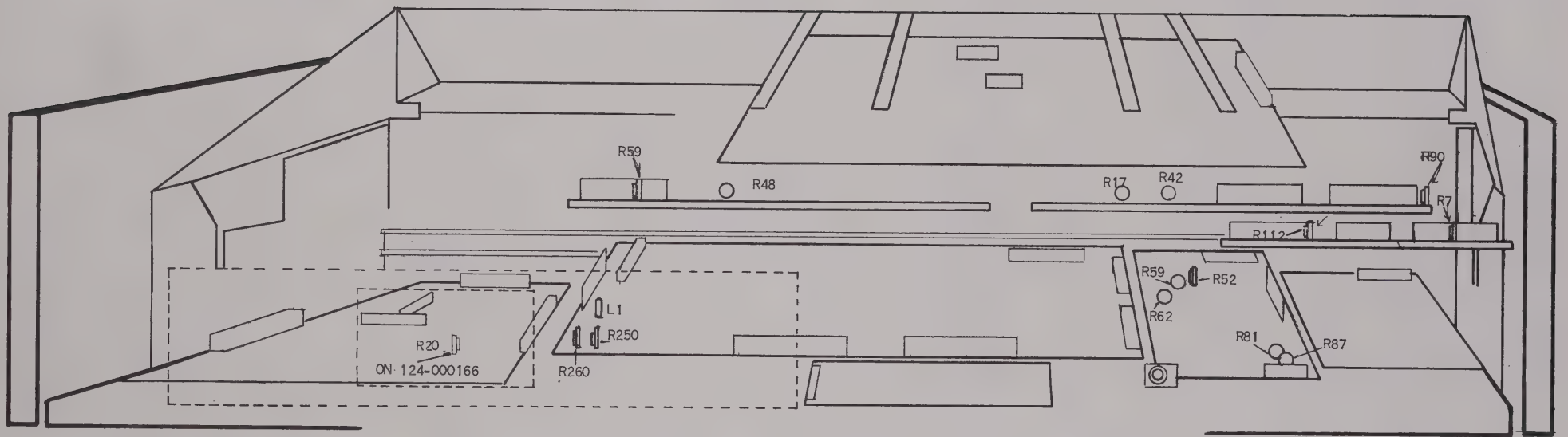
   F) Repeat steps C) through E).

2) **VCA ADJUSTMENTS AND MEASUREMENTS** NOTE: All adjustment locations are on 124-000503 PWB.

   A) **PREADJUSTMENTS:** Rotate R87 (null adjust) to mid-position. Rotate R81 (main Level) to maximum position (fully clockwise).

   B) **NULL ADJUST:** Press the Piccolo voice button on. Press down upper key 44 repeatedly. Adjust R87 (null adjust) for minimum transient at P61-15. The transient should be less than 200mV (P-P) after nulling.

   C) **LEVEL ADJUST:** Press Piccolo voice button on. Depress upper keys 8, 12, and 15. Adjust R81 (level adjust) for 5V RMS across main speaker.


R59
R48
R17
R42
R90
R7
R112
R59
R52
R62
R81
R87
L1
R250
R20
ON 124-000166
R260

SECTION III
EASE OF PLAY TESTING PROCEDURE

EASE OF PLAY TESTING PROCEDURE

A COMPLETE CHECK OF ALL BASS WALK PATTERNS GENERATED BY EASE OF PLAY CIRCUITRY REQUIRES THE PERFORMANCE OF 13 TESTS. THESE TESTS ARE OUTLINED IN THE TEST CHART LOCATED ON THIS PAGE.

PRETEST CONDITIONS:

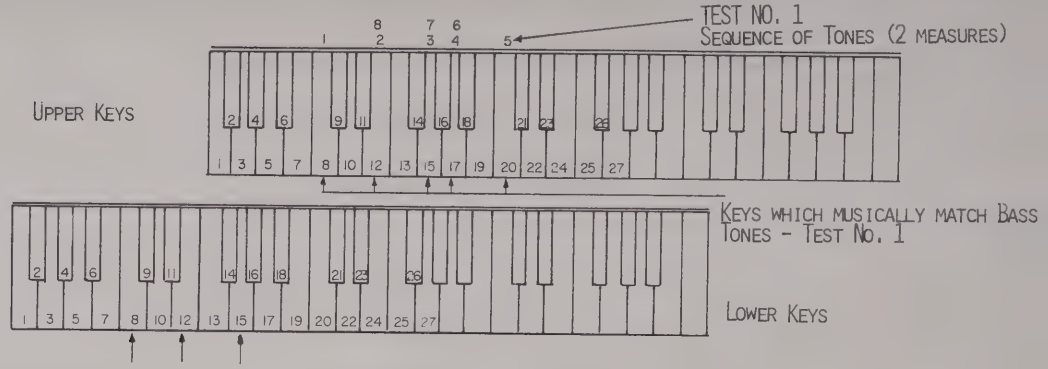
1. RHYTHM MUST BE ON; SILENT/SOUND SWITCH IN "SOUND" POSITION AND AUTOCHORD SWITCH IN "ON" POSITION.
2. BASS SWING/BASS WALK SWITCH MUST BE IN "BASS WALK" POSITION.
3. A BASS STOP AND AN UPPER MANUAL STOP MUST BE SELECTED.
4. NOTE-A-CHORD SWITCH "ON".

USING THE BASS WALK TEST CHART

TO USE THE TEST CHART, SIMPLY PERFORM THREE INDICATED STEPS FOR EACH ONE OF THE 13 TESTS.

TEST NO. 1, FOR INSTANCE, REQUIRES THAT DURING STEP 1 THE JAZZ PATTERNS SHOULD BE SELECTED; DURING STEP 2 LOWER MANUAL KEYS 8, 12, AND 15 SHOULD BE PRESSED DOWN; AND DURING STEP THREE UPPER KEYS 8, 12, 15, 17, AND 20 SHOULD BE PLAYED IN THE EIGHT NOTE SEQUENCE OF 8, 12, 15, 17, 20, 17, 15, 12. IF THE SYSTEM IS OPERATING PROPERLY, THE SEQUENCE OF BASS TONES WILL MUSICALLY MATCH THE SEQUENCE OF UPPER MANUAL KEYS (E.G. A "C" BASS NOTE SHOULD OCCUR IN THE SAME TIME SLOT AS A "C" UPPER MANUAL NOTE). THE SAME PRINCIPLE APPLIES TO ALL 13 TESTS SHOWN ON THE CHART.

NOTE:
BEGIN FOLLOWING BASS PATTERNS WITH UPPER KEYS, AT BEAT 1, MEASURE 1 OF THE RHYTHM SEQUENCE.

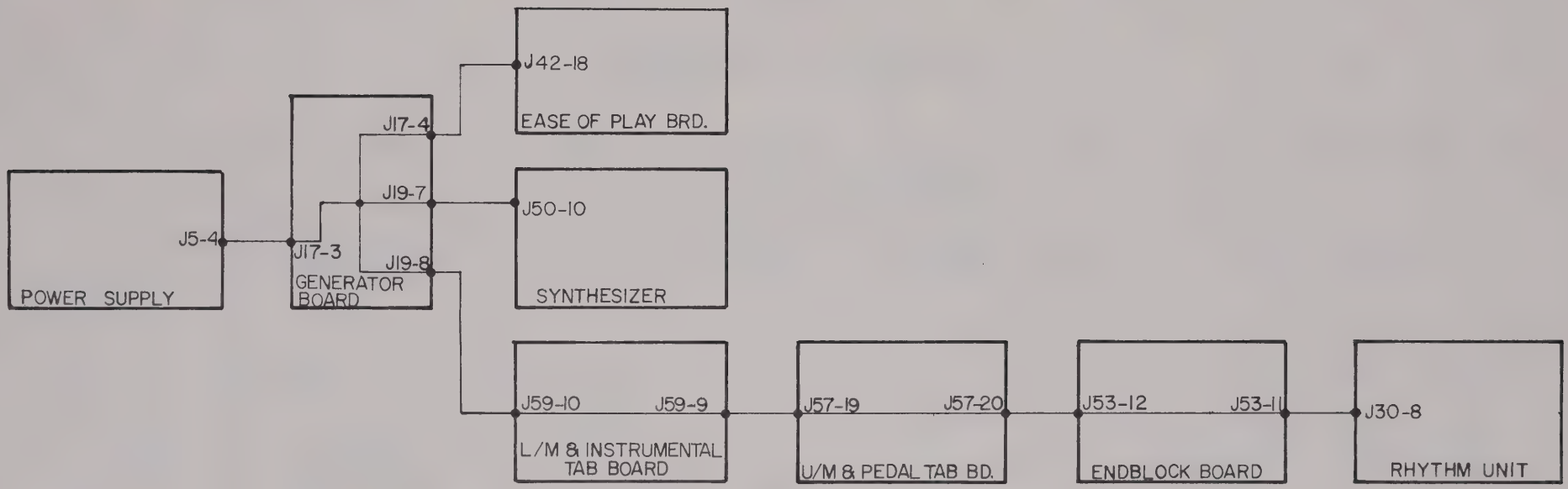


KEYS DEPRESSED
TEST NO. 1

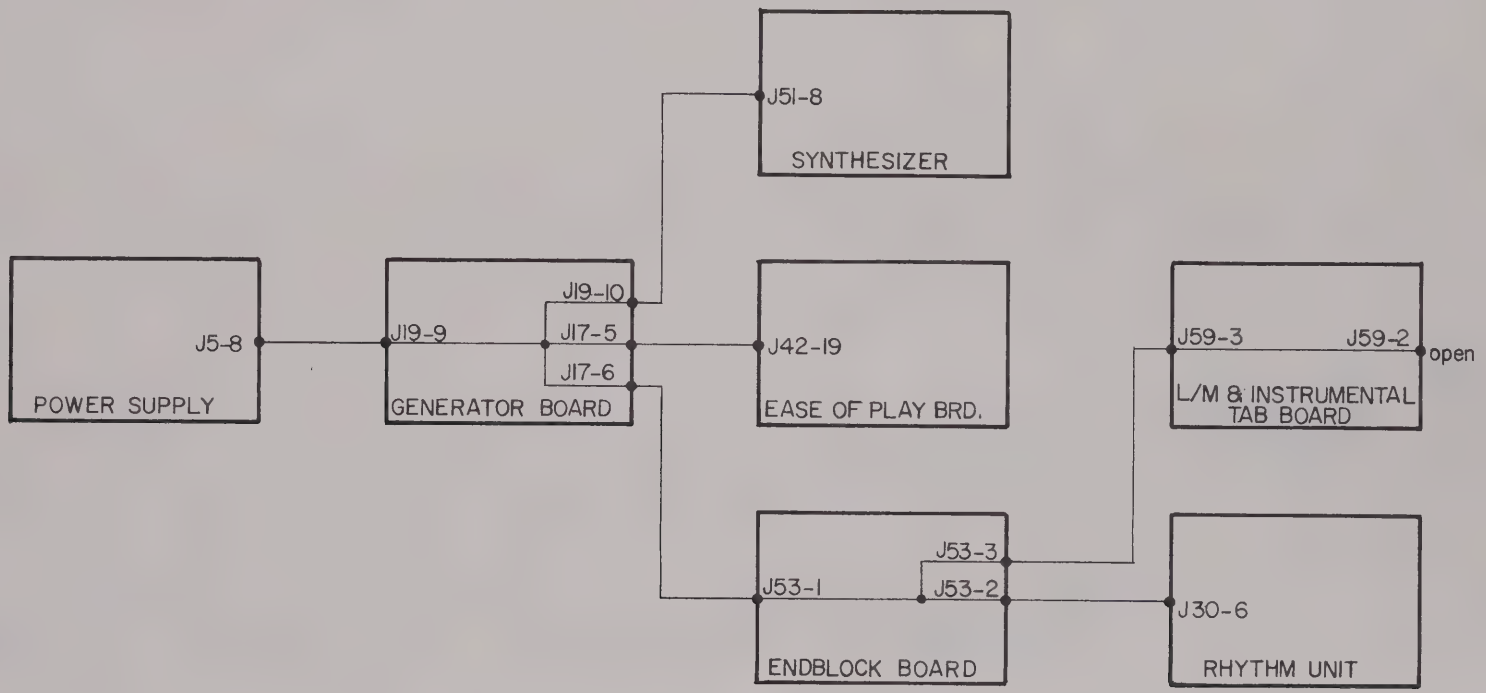
BASS WALK TEST CHART

	STEP NO. 1	STEP NO. 2	STEP NO. 3
TEST NO.	SELECT RHYTHM PATTERN:	PRESS LOWER KEYS:	MATCH BASS SEQUENCE WITH UPPER KEY SEQUENCE
1	JAZZ	8, 12, 15	8, 12, 15, 17, 20, 17, 15, 12
2	JAZZ	13, 17, 20	1, 5, 6, 7, 8, 6, 5, 3
3	JAZZ	18, 22, 25	6, 10, 8, 6, 5, 3, 2, 1
4	JAZZ	20, 23, 27	8, 8, 11, 15, 20, 15, 11, 15
5	JAZZ	13, 16, 20, 25	1, 4, 6, 7, 8, 6, 4, 3
6	JAZZ	18, 21, 25	6, 8, 3, 8, 6, 4, 2, 1
7	JAZZ	8, 12, 15, 18	20, 8, 12, 15, 20, 18, 17, 15
8	JAZZ	13, 17, 20, 23	13, 20, 17, 15, 13, 11, 7, 13
9	JAZZ	16, 18, 22, 25	6, 10, 8, 1, 6, 4, 3, 1
10	JAZZ	8, 10, 12, 13, 15	8, 10, 12, 13, 15, 13, 12, 10
11	LATIN	8, 12, 15	8, 8, 17, 15, 8, 15, 17, 15
12	LATIN	13, 17, 20	13, 13, 20, 12, 13, 20, 20, 12
13	LATIN	17, 21, 24	17, 12, 14, 17, 17, 14, 14, 12

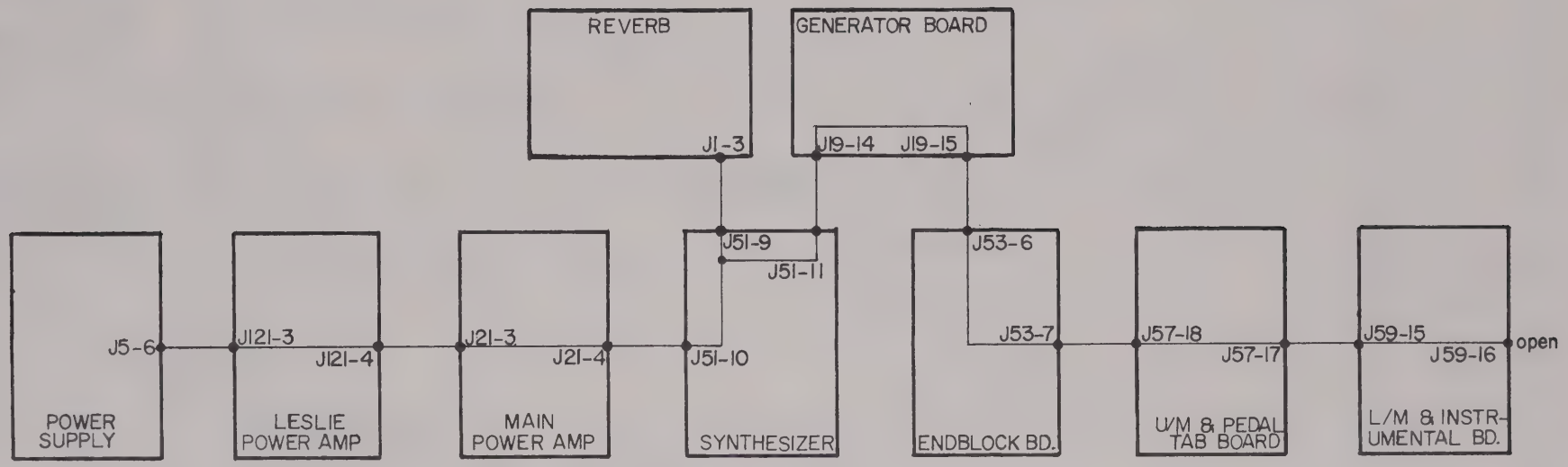
SECTION IV
POWER & GROUND DISTRIBUTION



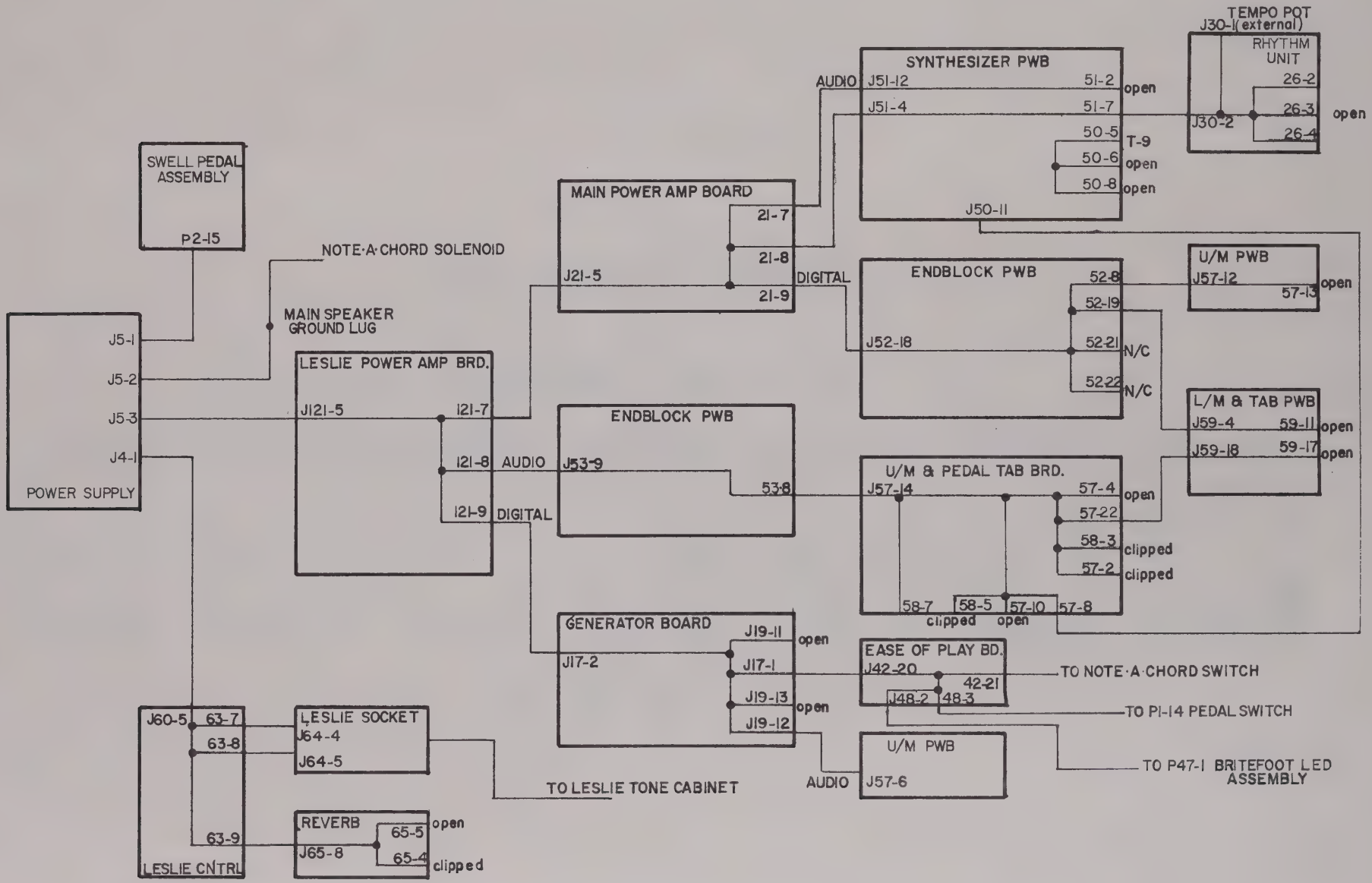
-14 VOLT DISTRIBUTION



-28 VOLT DISTRIBUTION

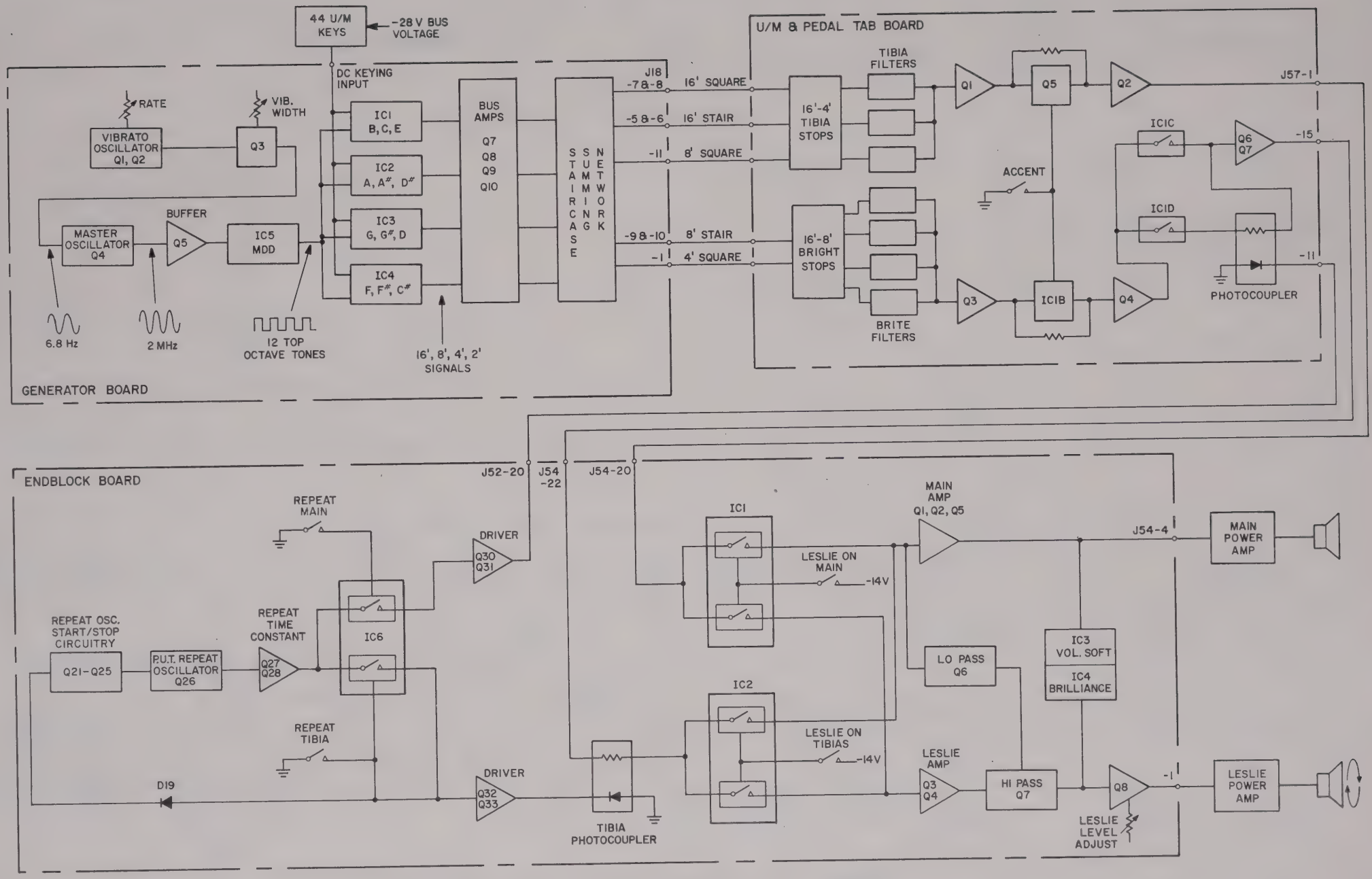


+25 VOLT DISTRIBUTION

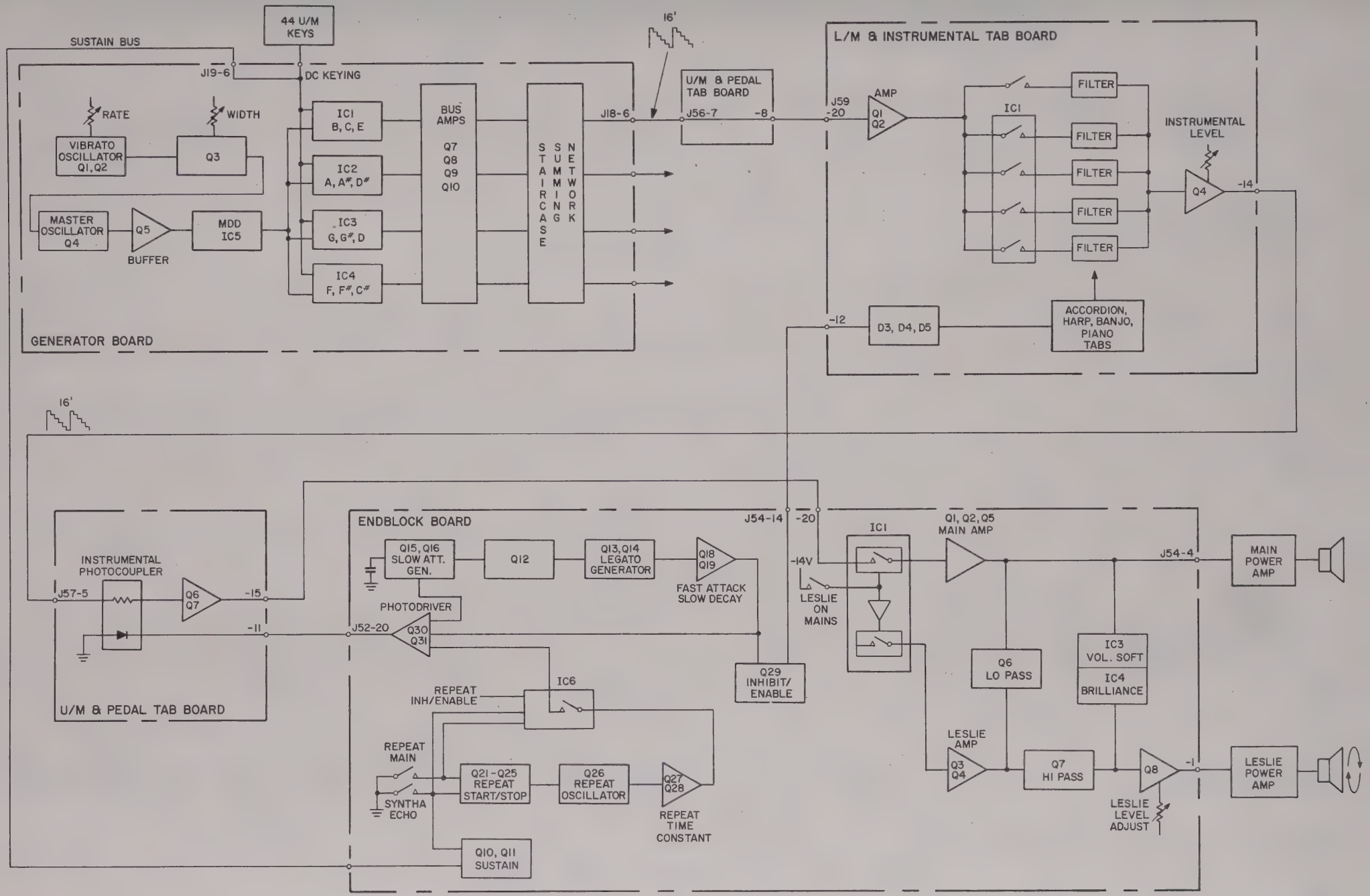


GROUND DISTRIBUTION

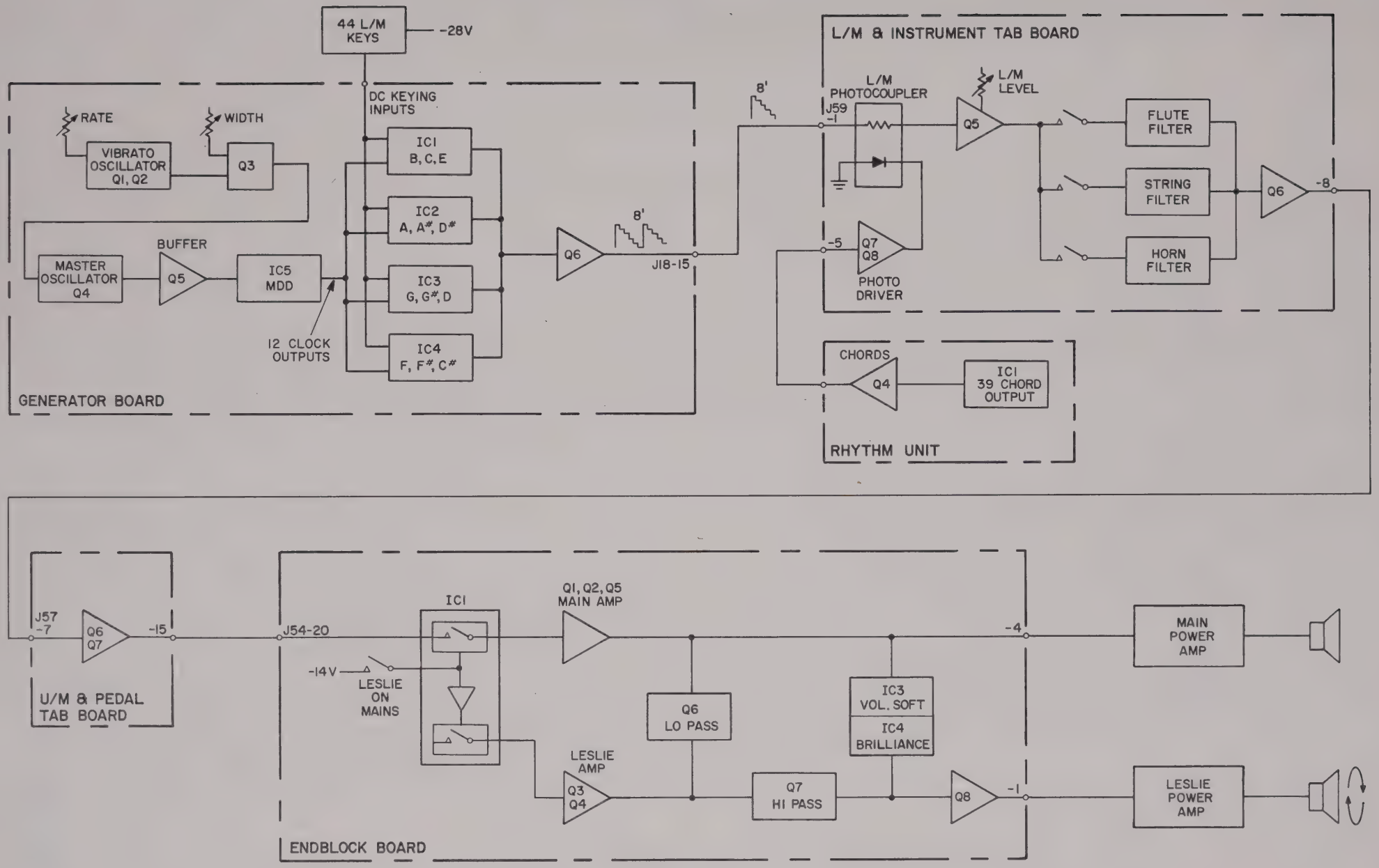
SECTION V
BLOCK DIAGRAMS



126100 UPPER TIBIAS AND BRIGHT (MAIN) VOICES



126100 UPPER INSTRUMENTAL VOICES



126100 L/M SYSTEM

SECTION VI
PRINTED WIRING BOARDS

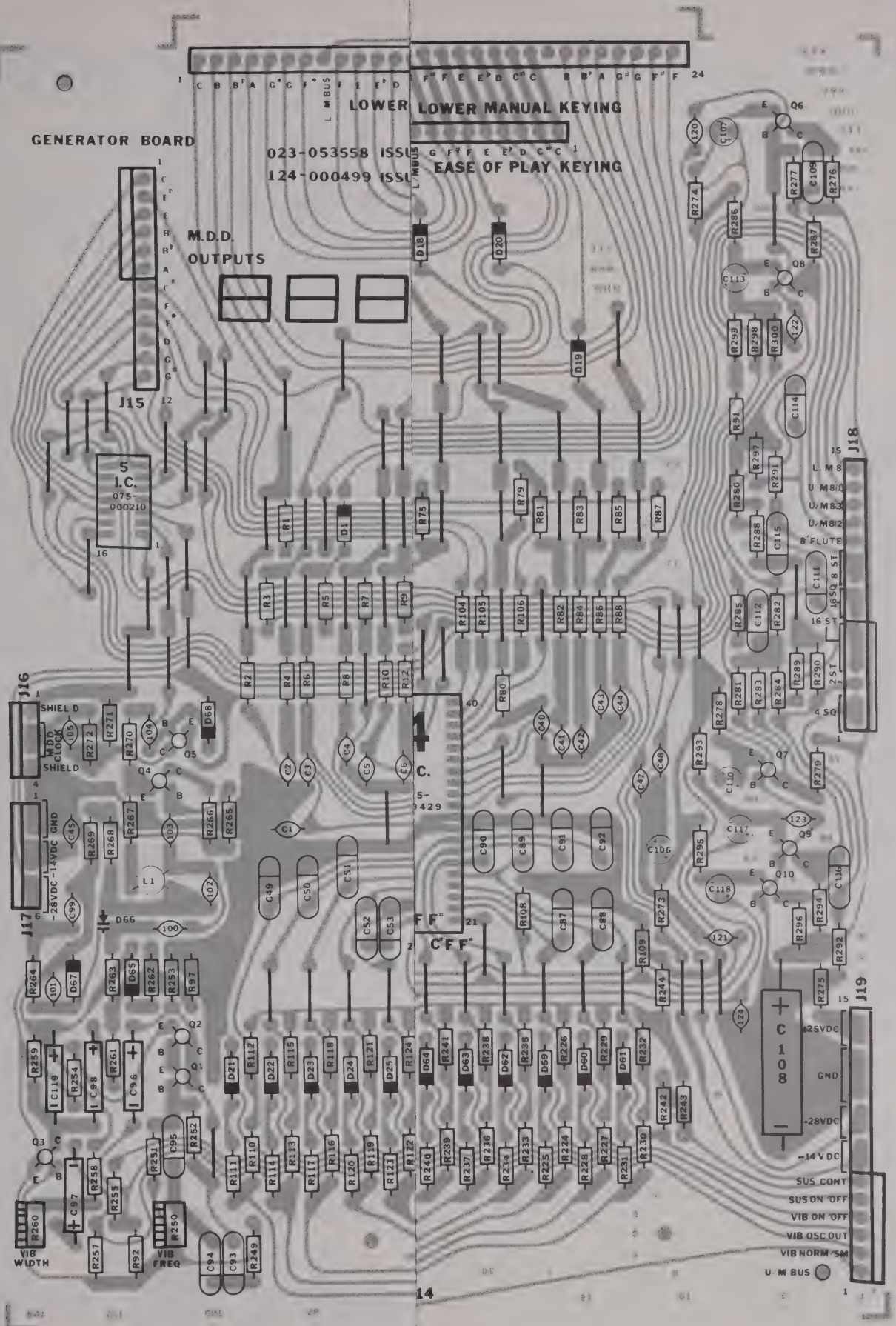


FIGURE 6-1
GENERATOR BOARD
(124-000499)

HANDLE I. C.'S WITH CARE

GENERATOR BOARD

023-053558 ISSUE 0
124-000499 ISSUE

M.D.D. OUTPUTS

J10 LOWER MANUAL KEYING

J11 LOWER MANUAL KEYING

J12 EASE OF PLAY KEYING

J13 UPPER MANUAL KEYING

J14 UPPER MANUAL KEYING

J15

J16

J17

J18

J19

1 I.C. 075-000429 BCE

2 I.C. 075-000429 ABE

3 I.C. 075-000429 GGD

4 I.C. 075-000429 CFF

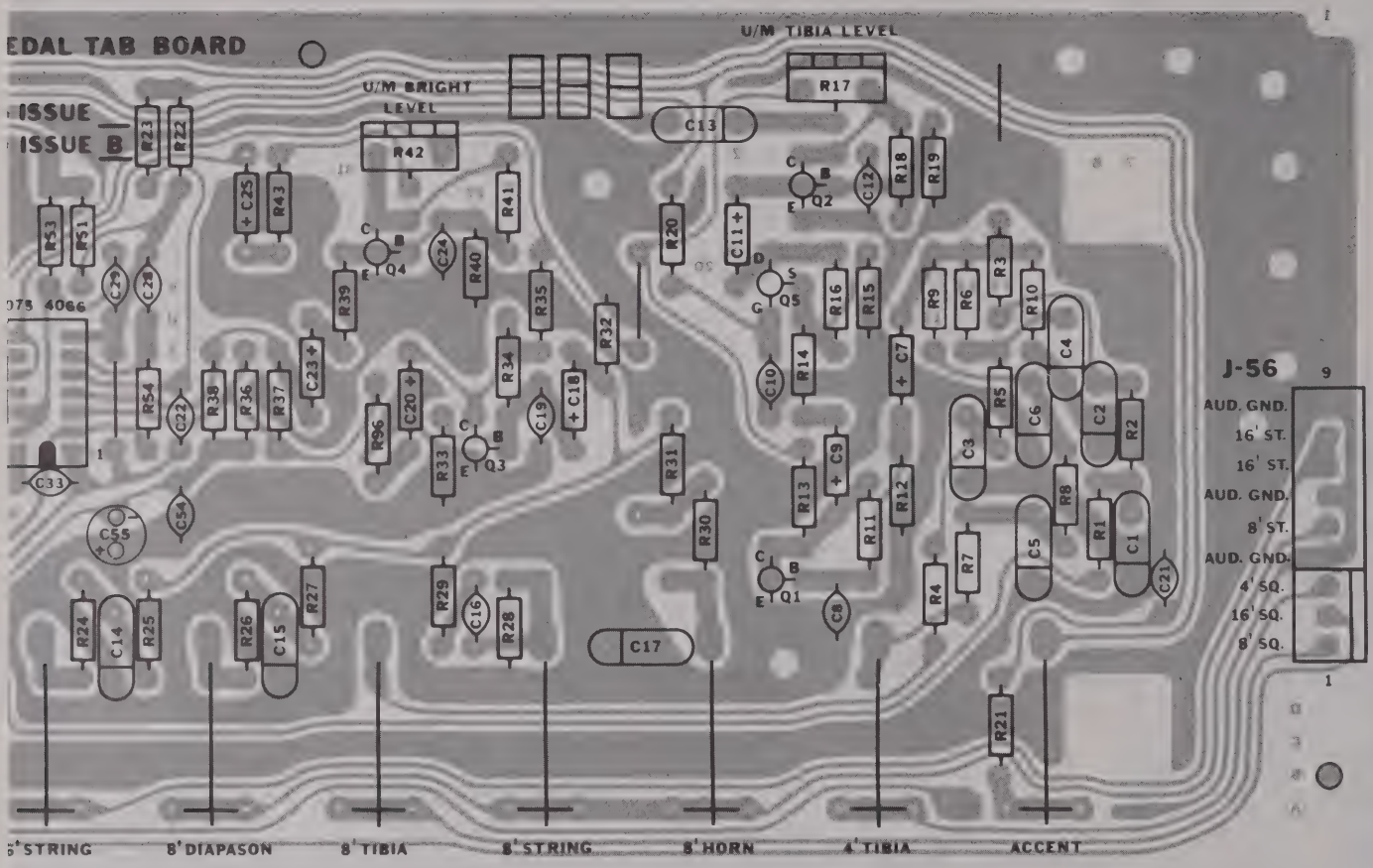
5 I.C. 075-000210

+25VDC
GND
-28VDC
-14 V DC
SUS CONT
SUS ON OFF
VIB ON OFF
VIB OSC OUT
VIB NORM SW
U M BUS

VIB WIDTH

VIB FREQ

FIGURE 6-1
GENERATOR BOARD
(124-000499)


EDAL TAB BOARD
ISSUE
ISSUE B
U/M BRIGHT LEVEL
U/M TIBIA LEVEL
R42
R17
C13
J-56
AUD. GND.
16' ST.
16' ST.
AUD. GND.
8' ST.
AUD. GND.
4' SQ.
16' SQ.
8' SQ.
5'STRING
8'DIAPASON
8'TIBIA
8'STRING
8'HORN
4'TIBIA
ACCENT

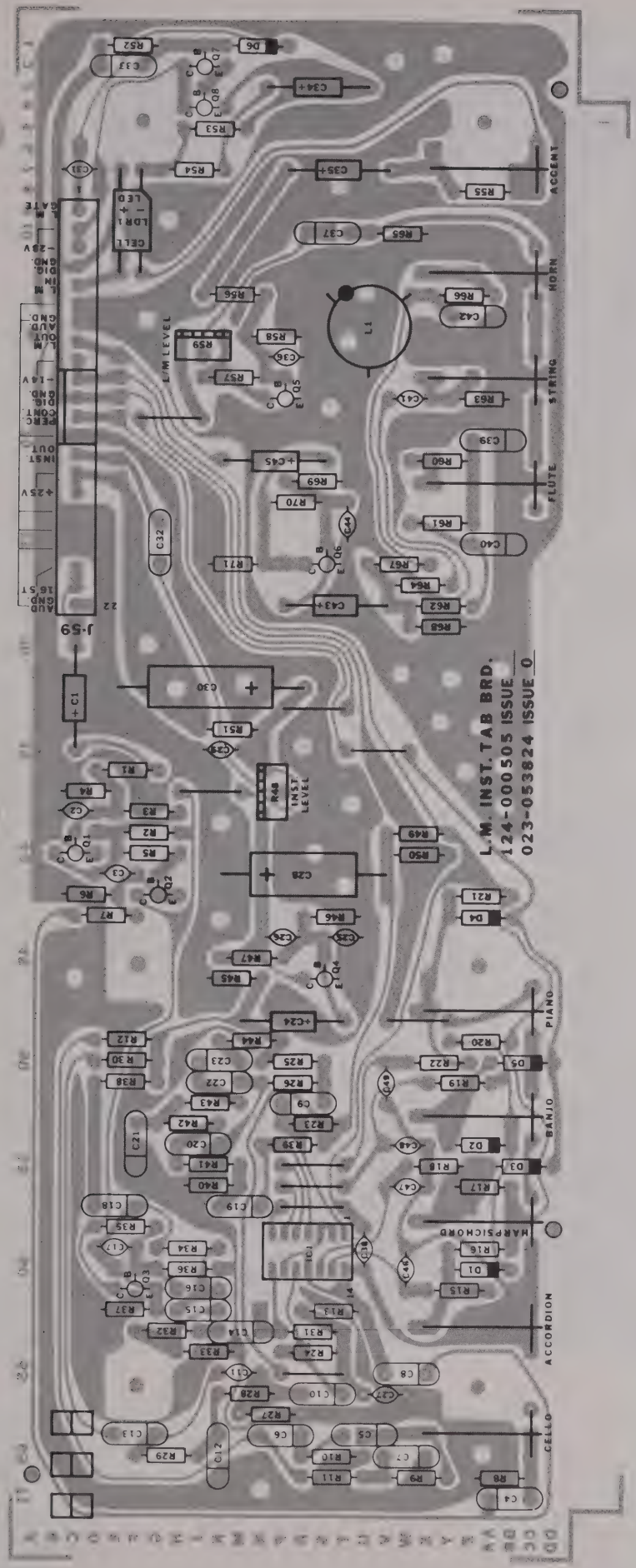


FIGURE 6-3
L/M & INSTRUMENT TAB BOARD
(124-000505)

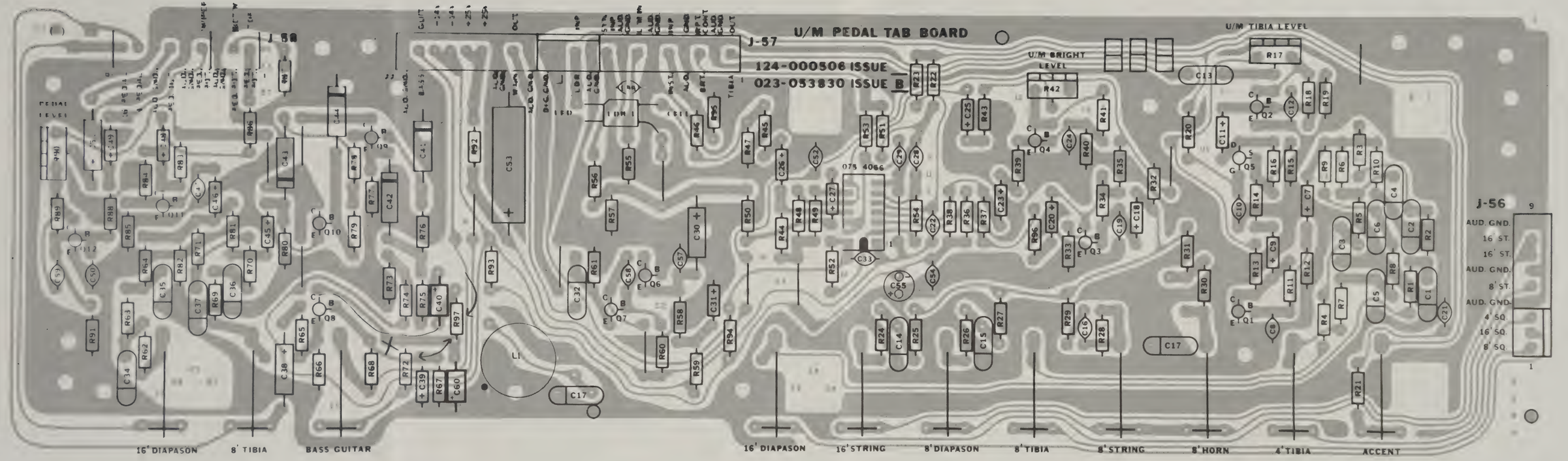


FIGURE 6-2
U/M & PEDAL TAB BOARD
(124-000506)

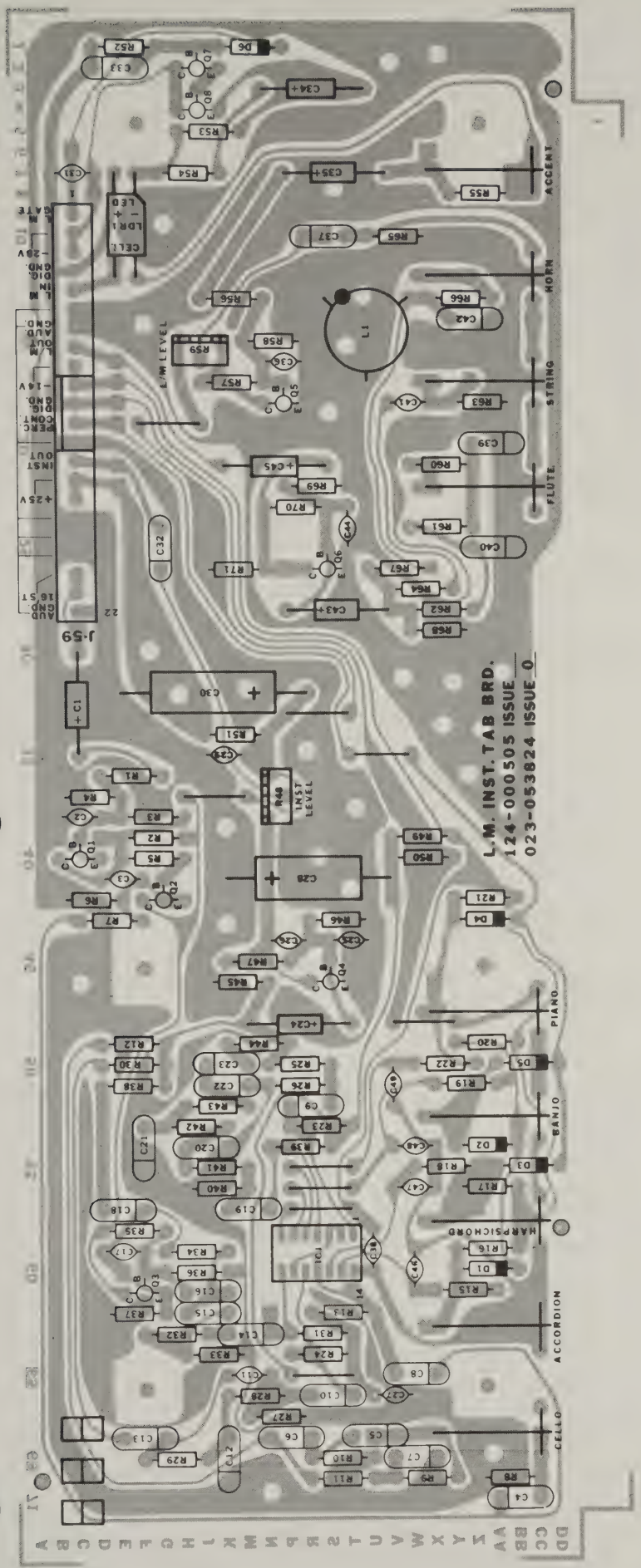


FIGURE 6-3
L/M & INSTRUMENT TAB BOARD
(124-000505)

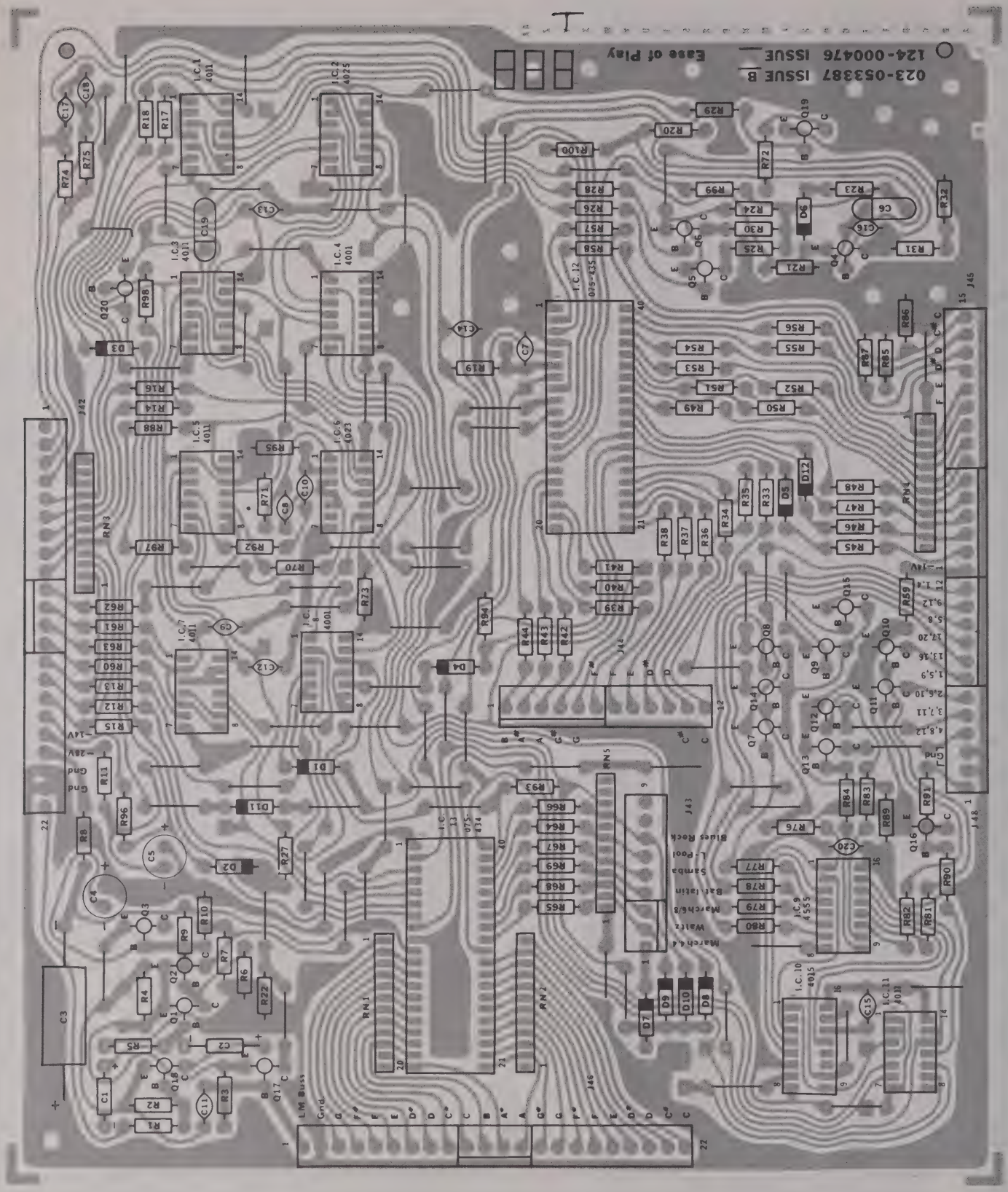


FIGURE 6-4
EASE OF PLAY BOARD
(124-000476)

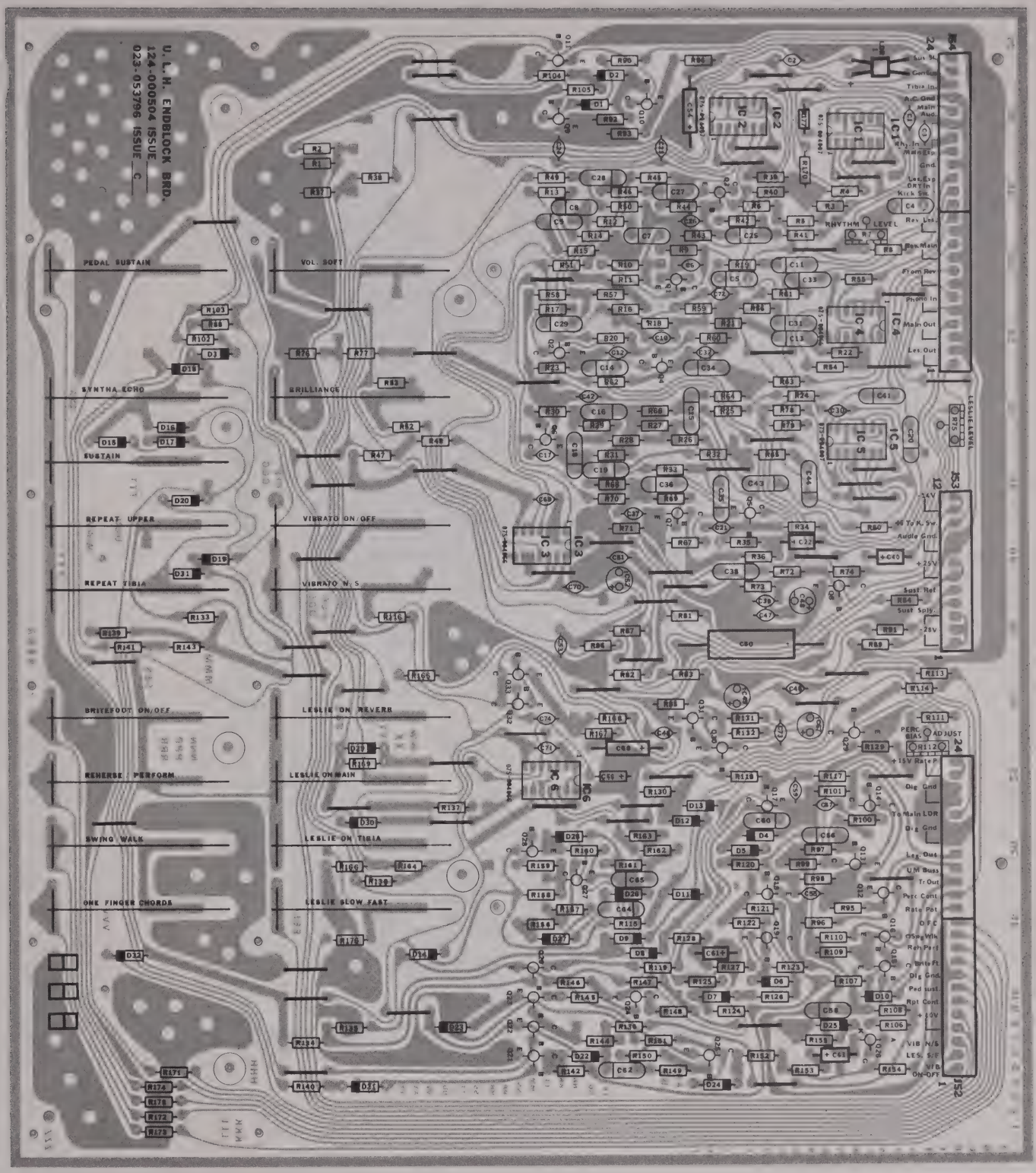


FIGURE 6-5
ENDBLOCK BOARD
(124-000504)

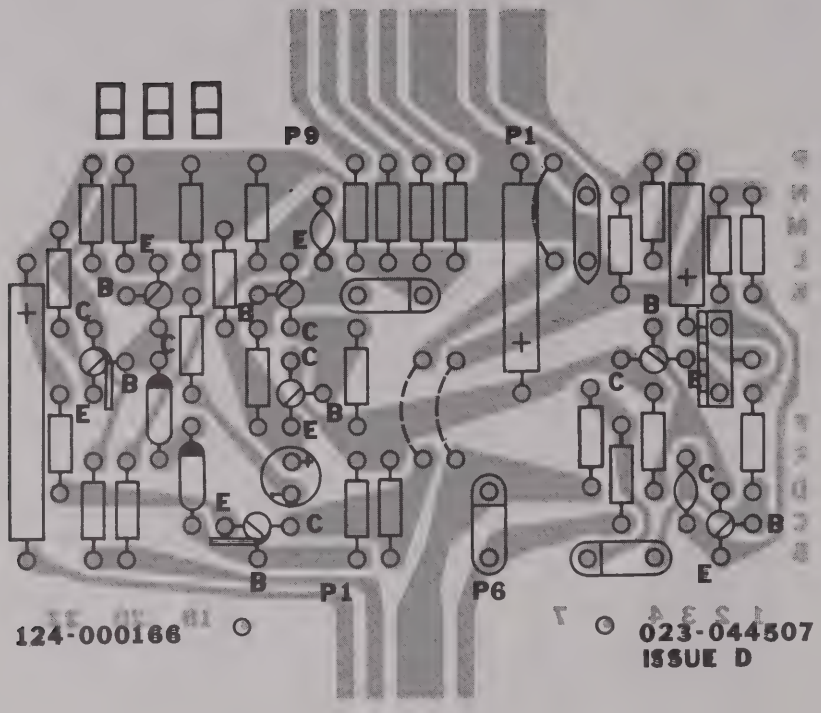


FIGURE 6-6
REVERBERATION BOARD
(124-000166)

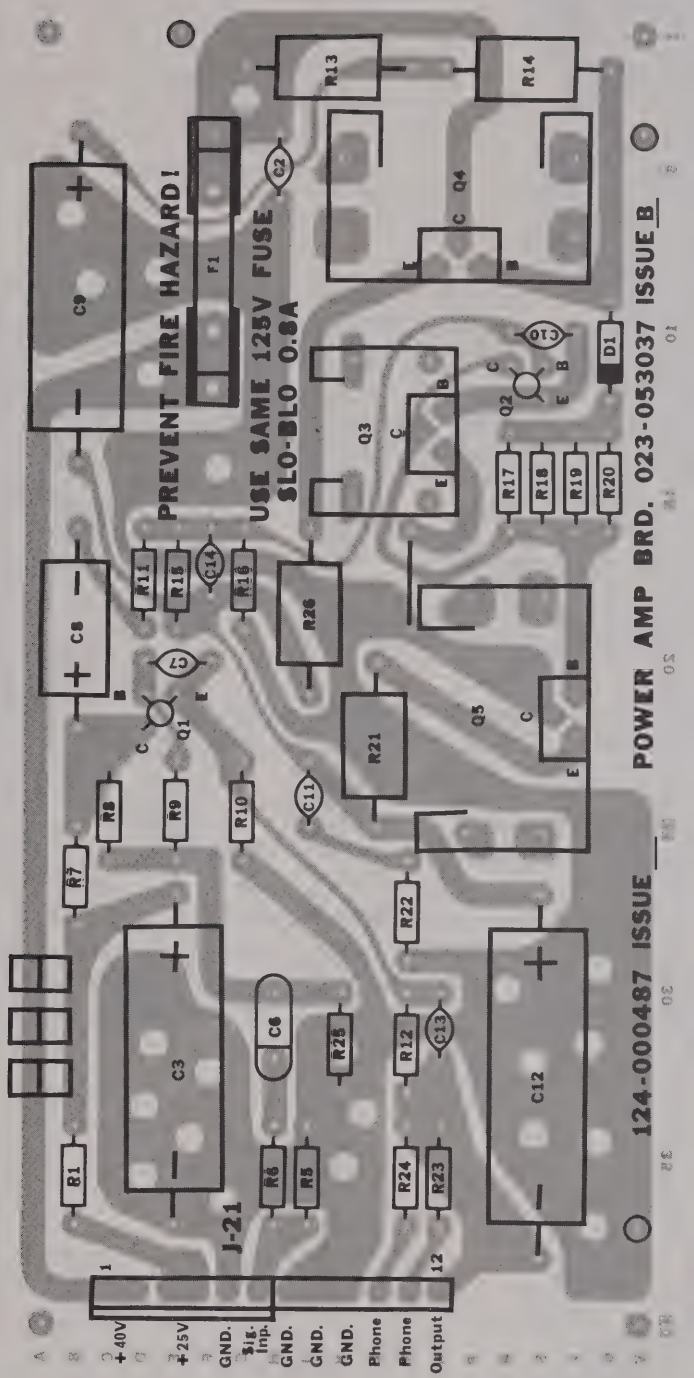


FIGURE 6-7
MAIN POWER AMP BOARD
(LESLIE POWER AMP BOARD)
(124-000487)

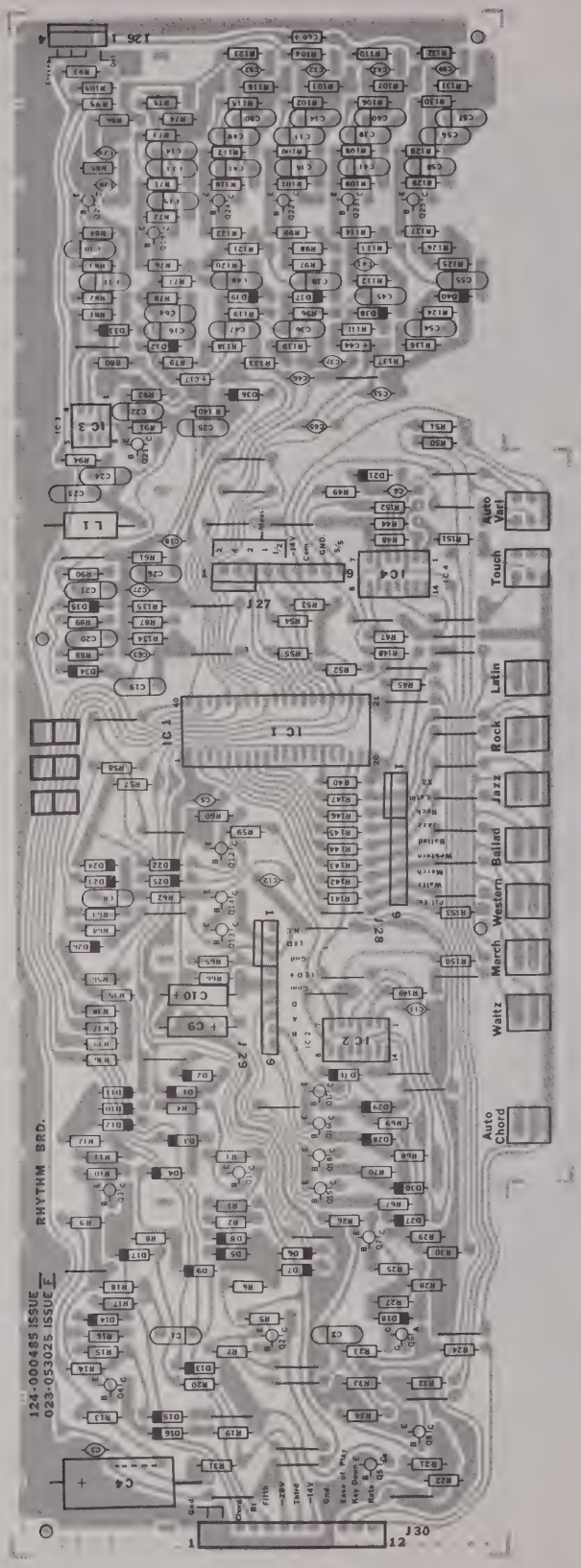


FIGURE 6-8
RHYTHM UNIT BOARD
(124-000485)

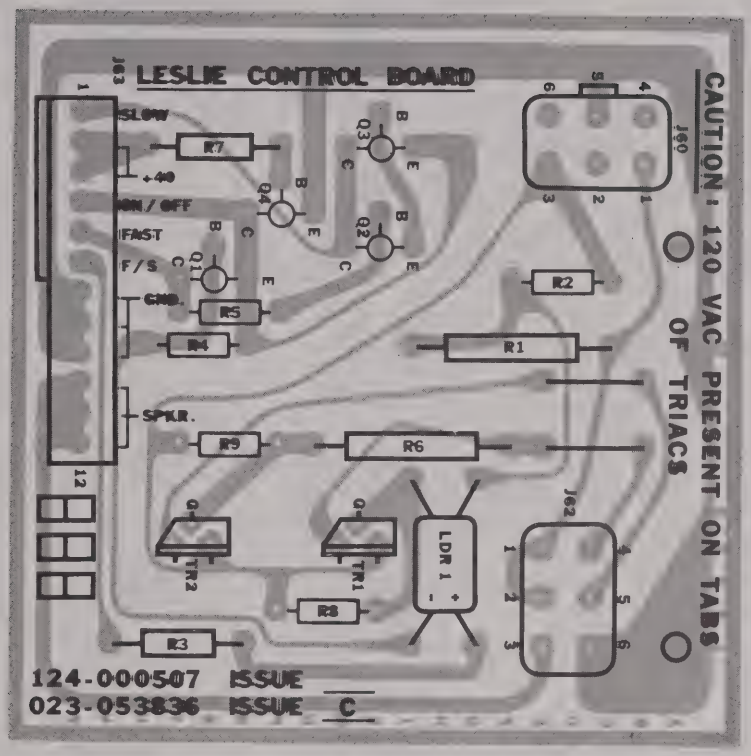


FIGURE 6-9
LESLIE CONTROL BOARD
(124-000507)

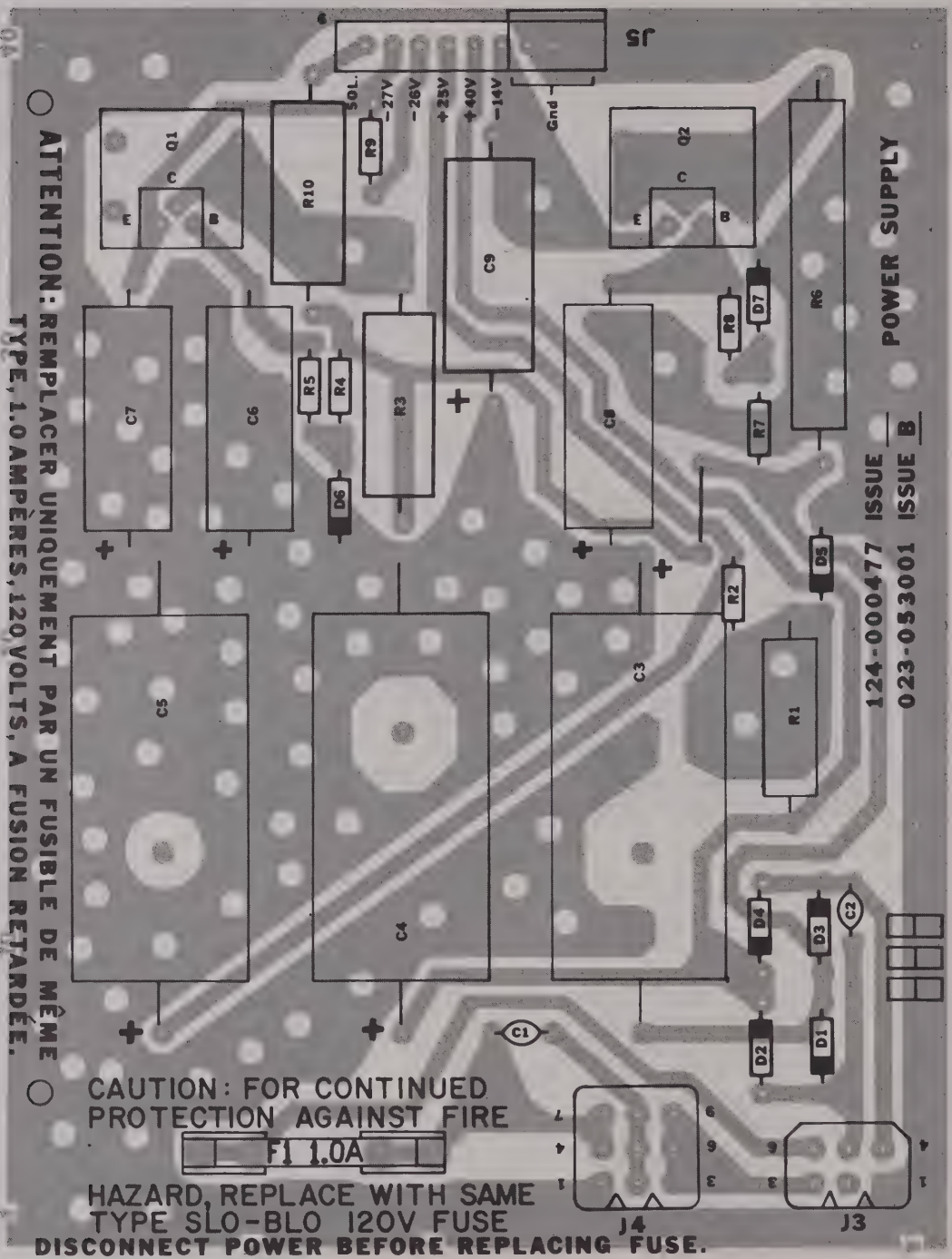


FIGURE 6-10
POWER SUPPLY BOARD
(124-000519)

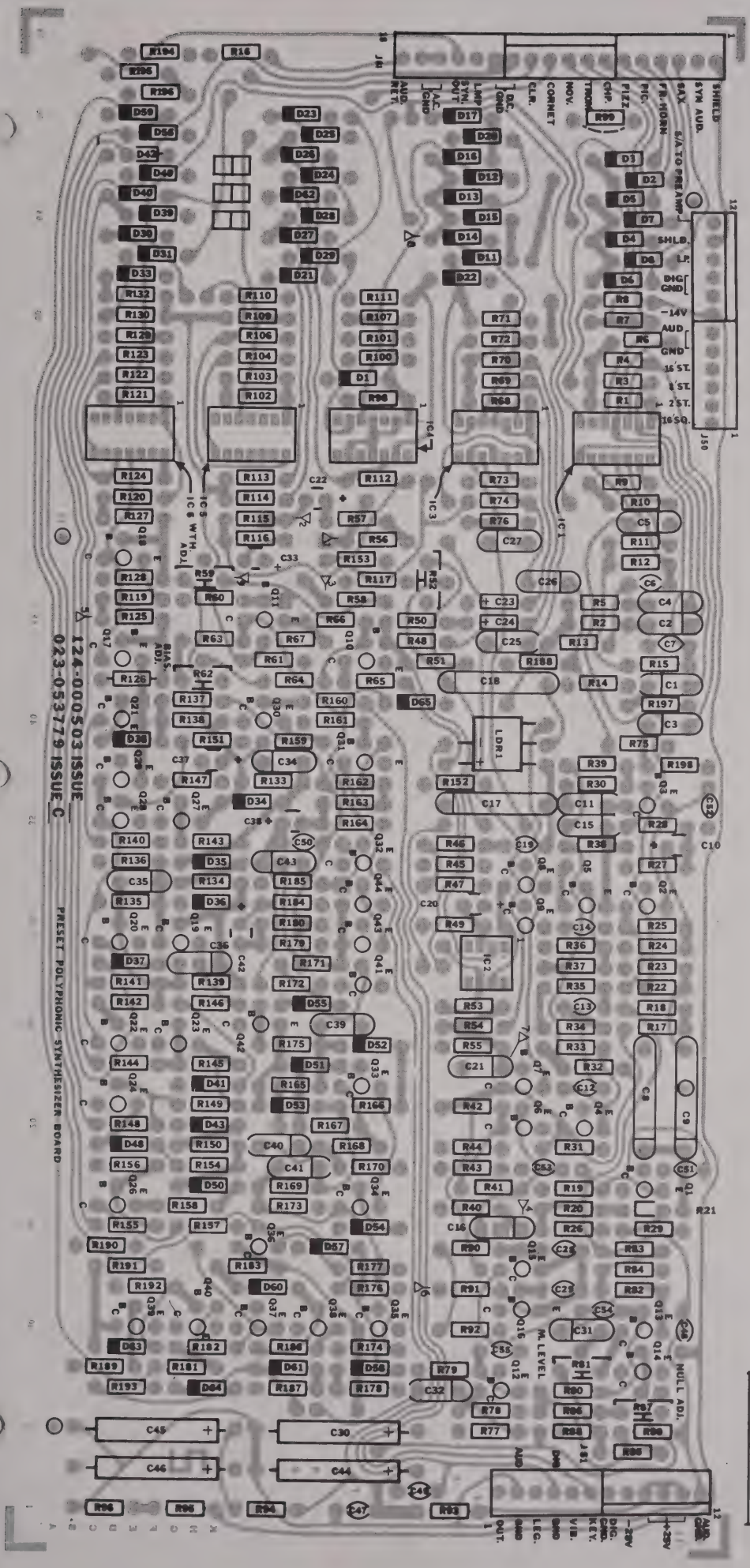


FIGURE 6-11
POLYPHONIC SYNTHESIZER BD.
(124-000503)

SECTION VII
PARTS LIST

ORGAN CABINET AND RELATED COMPONENTS

Top and Music Panel Assemblies		
126114		051-003391
126122		051-003390
Top Assembly (Only)		
126114		051-003395
126122		051-003394
Music Assembly (Only)		
126114		051-003483
126122		051-003454
Cabinet Assembly		
126114		111-126144
126122		111-126122
Panel & Grille Cloth Assy.		
126114		052-053860-002
126122		052-053860-001
Rear Cover		
Screws		056-053753
Rotary Speaker		
(Leslie Two Speed)	120V/60HZ	121-000203-001
Main Speaker		014-044549
Full End Panel Left Hand		
126114		051-003488
126122		051-003460
Full End Panel Right Hand		
126114		051-003489
126122		051-003461
Leg Assembly Left Hand		
126114		051-003508-003
Leg Assembly Right Hand		
126114		051-003508-004
Front Strip		041-053204
Label (One Finger Chords)		038-053447
Transformer & Plug Assembly	120V/60HZ	003-053813
AC Power Cable	120V/60HZ	001-053745

BENCH ASSEMBLY (PACKED)

126114	152-126114
126122	152-126122

MANUAL, PEDAL, AND ENDBLOCK ASSEMBLIES

Endblock Assembly Upper L.H.	
126114	067-053297-002
126122	067-053297-001
Endblock	
126114	061-053737
126122	061-053736
Endblock Voicing Board	124-000504
Rocker Chassis Assembly	060-053296
Rocker Tab Plate	040-050800
Stamped Rocker Tabs	
Volume Soft	031-050966-014
Brilliance	031-050966-015
Vibrato Off/On	031-050966-028

Lower Manual Assembly	119-000083
PWB Assembly #1	023-045694-003
PWB Assembly #2	023-045695-003
Cancellation Assembly (Preset Bar)	060-053454
Plunger & Link Assembly	060-053459
Solenoid Assembly	063-053460
Keys and Spring Assy.	
F to CX Ivory	057-045707-005
C to E Ivory	057-045709-005
F to B Ivory	057-045708-005
C to E Note-A-Chord Ivory	057-053242-005
F to B Note-A-Chord Ivory	057-053242-006
Pedal Switch Assembly	116-000029
Pedal Chassis Assembly	009-045424
Pedal (Natural)	025-045441
Pedal (Sharp)	025-045442
Cover Assembly	046-045452-001

CONTROL ASSEMBLIES

Upper Control Panel (Screened)	061-053818
Lower Control Panel	041-053719
Control Tab Mounting Panels	
3 Station	041-053716-003
4 Station	041-053716-004
5 Station	041-053716-005
8 Station	041-053716-008
Detent Spring	012-043149
Limit Wires	
3" Length	013-043160
3-7/8" Length	013-043161
4-3/4" Length	013-043162
7-3/8" Length	013-043163
Pivot Shafts	
3-1/4" Length	020-049677
4-1/8" Length	020-049678
5" Length	020-049679
7-5/8" Length	020-049680
Control Tabs	
Diapason 16'	031-053732-001
Flute 8'	031-053732-002
Bass Guitar	031-053732-003
Tibia 16'	031-053732-004
String 16'	031-053732-005
Diapason 8'	031-053732-006
Tibia 8'	031-053732-007
String 8'	031-053732-008
Horn 8'	031-053732-009
Tibia 4'	031-053732-010
Accent	031-053732-011
Cello	031-053732-012
Accordion	031-053732-013
Harpsichord	031-053732-014
Banjo	031-053732-015
Piano	031-053732-016

Vibrato Normal/Small	031-050966-30
Leslie On Reverb	031-050966-059
Leslie On Main	031-050966-060
Leslie On Tibia	031-050966-061
Leslie Slow/Fast	031-050966-049
Pedal Sustain	031-050966-034
Syntha Echo	031-050966-022
Repeat Tibia	031-050966-062
Sustain	031-050966-033
Repeat Upper	031-050966-064
Britefoot Off/On	031-050966-056
Britefoot Rehearse/Perform	031-050966-057
Bass Swing/Bass Walk	031-050966-058
One Finger Chords	031-050966-054
Filler Blocks	025-051100
Endblock Assembly Upper R.H.	
126114	067-052715-001
126122	067-052714-001
Endblock	
126114	051-001244-006
126122	051-001244-005
Upper Manual Assembly	119-000077
PWB Assembly #1	023-045694-003
PWB Assembly #2	023-045695-003
Keys & Spring Assembly	
F-CX Ivory	057-045707-003
F-B Ivory	057-045708-005
Endblock Assembly Lower L.H.	
126114	067-053725-001
126122	067-053725
Selector Switch Assembly (10 Stations)	008-053724
Indicator Lamp	016-052000
Illuminator	063-053865
Bezel	025-053700
Endblock	
126114	051-053726-001
126122	051-053726
Inlay (Pushbutton)	038-053715
Inlay (Slide Pot)	038-053714
Knob	025-052701-001
Endblock Assembly Lower R.H.	
126114	067-053193-002
126122	067-053193-001
Endblock	
126114	051-053192-002
126122	051-053192-001
Label (Note-A-Chrod)	038-053191
Inlay (Rocker Tab)	038-053196

Rhythm Control Panel Assembly	120-000093
Control Panel(Screened)	061-053817
Rhythm Control Panel Bracket	035-053713
Selector Switch Assembly (4 Station)	008-053731
Switch Assembly (Silent/Sound)	008-053186
Inlay Silent/Sound	038-053199
Escutcheon Silent/Sound	025-053336
Gold Knobs for Slider Pots	025-053145-001
Rhythm Knobs (Measure Select)	
1/2 Measure	025-050933-010
1 Measure	025-050933-008
2 Measure	025-050933-006
4 Measure	025-050933-004
Rhythm Knobs (Pattern Select & Control)	
Autochord	025-050933-011
Waltz	025-050933-010
March	025-050933-009
Western	025-050933-008
Ballad	025-050933-007
Jazz	025-050933-006
Rock	025-050933-005
Latin	025-050933-004
Touch	025-050933-003
Auto Vari	025-050933-002
Variation Housing (A,B,C,D.)	025-050390
Lens "A"	025-053116
Lens "B"	025-053117
Lens "C"	025-053118
Lens "D"	025-053119
Leslie Label	038-052730
Hammond Logo	037-052752
Tempo Slide Pot 1MEG	676-053142
Rhythm Volume Slide Pot 50K	676-053141
Gold Slider Knobs	025-053145-001
Tempo LED	001-053746
Tempo LED Mounting Clip	013-060619
Tempo LED Mounting Collar	013-060620

MISCELLANEOUS SUB ASSEMBLIES

Britefoot Assembly	063-053393	
Housing	026-052400	
Britefoot Board	124-000498	
End Cap (Left Hand)	025-053300-001	
End Cap (Right Hand)	025-053300-002	
Indicator Strip	038-052900	
Expression Pedal Assembly	112-000083	
Bass	025-051469	
Dual Photo-Cell	040-045401	
Pedal (Only)	025-045384	
Bulb (Bayonet)	016-031748	(GE1866)
Reverb Unit (Assy w/Brackets) (Late Production 207)	121-000206	
Reverb Board	124-000166	

PRINTED WIRING BOARDS

Rhythm Board		124-000485	
Q1, 2, 8	PNP	001-021172	2N249
Q6	PUT	001-026050	2N6027
Q7, 12, 13, 14	NPN	001-021133	2N3393
Q15-18	PNP	001-021173	2N4249
Q19, 21-25	NPN	001-021134	2N3392
Q20		001-021135	2N3391
IC-1		075-000433	
IC-2		075-004013	CD4013B
IC-3		075-000300	MM5837N
IC-4		075-004011	CD4011B
D1-40		001-026080	1N4148
L1		003-030753	
Selector Switch		008-053139	
C4	Elect. 200MFD/35V	431-027359	
C9, 10	Elect. 100MFD/50V	431-106509	
C17, 60	Tant. 1.0MFD/25V	414-240092	
C44	Tant. .47MFD/25V	414-240052	
Knob, Auto-Vari		025-050933-002	
Knob, Touch		025-050933-003	
Knob, Latin		025-050933-004	
Knob, Rock		025-050933-005	
Knob, Jazz		025-050933-006	
Knob, Ballad		025-050933-007	
Knob, Western		025-050933-008	
Knob, March		025-050933-009	
Knob, Waltz		025-050933-010	
Knob, Auto-Chord		025-050933-011	
Escutcheon		025-053131	
S/S Rocker Tab Switch		008-053186	

EASE OF PLAY BOARD		124-000476	
Q1, 2, 7-18	NPN	001-021133	2N3393
Q3,4,5,6,19,20	PNP	001-021172	2N4249
D1-12	Signal	001-026080	1N4148
IC-13		075-000434	
IC-12		075-000435	
IC4, 8		075-004001	CD4001B (RCA)
IC-1, 3, 5, 7, 11		075-004011	CD4011B (RCA)
IC-10		075-004015	
IC-6		075-004023	
IC-2		075-004025	
IC-9		075-004555	
C-2	Tant. 15MFD/15V	414-030162	
C-3	Elect. 47MFD/50V	431-506059	
C-4	Elect. 10MFD/50V	432-106509	
C-5	Elect.100MFD/15V	432-107159	

POWER AMP BOARD		124-000487	
Q2	NPN	001-021100	2N5175
Q1	NPN	001-021260	2N5826
Q3	NPN	001-021320	D44C5
Q4	NPN	001-021330	2N6292
Q5	PNP	001-022090	2N6107
D1		001-026110	1N4001

PRESET POLYPHONIC SYNTHESIZER BOARD			124-000503	
Q1-9, 12,13,14		NPN Low Noise ...	001-021260	2N5826
Q10		PNP	001-021173	2N4249
Q26-40,42,43,44		PNP	001-021172	2N4249
Q11		NPN	001-021135	2N3391
Q17,18,21,23,24,25		NPN	001-021134	2N3392
Q15, 16		NPN (Matched Pair)	001-021260-001	2N5826(match)
D1			001-223026	1N4744
D2-8, 11,17,20,31, 33,43,48,64			001-226080	1N4148
D65	Zener	15V/1Watt	001-223028	
IC-1, 3,4,5,6			075-004066	MC14066
IC-2			075-000090	
LDR1		Photocoupler	040-051548	
C30,44,45,46	Elect	100MFD/25V	431-107259	
C23,24	Tant.	.33MFD/25V	414-240042	
C10, 20	Tant.	1MFD/35V	435-105352	
C22,33,38	Tant.	2.2MFD/35V	435-225352	
C37, 42	Tant.	4.7MFD/35V	435-475352	
R59	Trimmer Pot	2K	676-000059	
R62, 87	Trimmer Pot	5K	676-000061	
R52	Trimmer	" 10K	676-000064	
R81	Trimmer	" 20K	676-000065	
LOWER MANUAL & INSTRUMENTAL BOARD			124-000505	
Q1-6		NPN Low noise	001-021260	2N5826
Q7, 8		PNP	001-021173	2N4249
IC-1			075-004066	MC14066
D1-6			001-226080	1N4148
D7	Zener	20V/1 Watt	001-023032/31	1N4747
LDR 1		Photocoupler	040-049945	
C45	Tant.	.47MFD/25V	414-240052	
C1, 24,34,43	Elect	100MFD/50V	431-056509	
C28	Elect	100MFD/25V	431-107259	
C30	Elect	200MFD/35V	431-207359	
R59	Trimmer Pot	5K	676-000061	
R48	Trimmer "	10K	676-000064	
UPPER MANUAL & PEDAL TAB BOARD			124-000506	
Q1-4,6,7,9-12		NPN Low Noise	001-021260	2N5826
Q8		PNP	001-021173	2N4249
Q5	N Channel	FET	001-027030	2N5163
IC-1			075-004066	MC14066
LDR1		Photocoupler	040-049495	
L1			003-049346	
C-51	Tant	.47MFD	414-240052	
C30,38,51	Elect	47MFD/50V.....	431-056509	
C53	Elect	10MFD/15V.....	431-106509	
C55	Elect	100MFD/15V.....	432-107159	
C26	Tant.	.33MFD/25V	414-240042	
C7,9,11,18,23, 27,31,45,61, 48,49,60	Tant	1.0MFD/25V	414-240092	
C39	Tant	.....	414-240112	
C20,25,40	Tant	.....	414-250092	
R17, 42, 90	Trimmer	100K	676-000064	
D1	Zener	20V	001-023032/31	1N4747

POWER AMP BOARD CONTINUED

C8	Elect. 4.7MFD/50V	431-056509	
C3, 9	Elect. 100MFD/50V	431-107509	
C12	Elect. 470MFD/35V	431-507359	
R13	82 OHM/2 Watt.....	600-040231	
R14	180 OHM/2 Watt.....	600-040311	
R21, 26	.47 OHM/2 Watt.....	601-040021	
F1	.8 Amp Slow Blo ..	016-040426	

PEDAL ASSEMBLY 116-000029

BRITEFOOT ASSEMBLY 063-053393

Britefoot Board	124-000498
LED	001-026120
Sub. Min. Lamp	016-051094
End Cap. L.H.	025-053300-001
End Cap. R.H.	025-053300-002

GENERATOR BOARD 124-000499

Q1, 2		NPN	001-021133	2N3393
Q3		NPN	001-021134	2N3392
Q6-10		NPN	001-021135	2N3391
Q4, 5		NPN	001-021310	2N4123
D1-65, 68		Signal	001-026080	1N4148
D66			001-026090	MV2115
D67			001-223038	
IC-5			075-000220	
IC1-4			075-000429	
C96,97,98,110	Elect	4.6MFD/50V	431-056509	
C108	Elect	200MFD/35V	431-207359	
C107,106,110,113, 118	Elect	100MFD/15V	432-107159	
L-1		Coil	003-051656	
R-260	Trimmer	100K	676-000073	
R250	Trimmer	250K	676-000077	

PERCUSSION BOARD 124-000482

Q7, 11,12, 15		NPN	001-021133	2N3393
Q1, 2, 3		NPN	001-021134	2N3392
Q19		NPN	001-021135	2N3391
Q4,5,6,8,10,13,14		PNP	001-021172	2N4249
Q17, 18		PNP	001-021173	2N4249
Q10, 21,22,23		NPN	001-021260	2N5826
Q16		PUT	001-026050	2N6027
D1-25, 27, 28		Signal	001-026080	1N4148
IC-1			075-004066	
C39	Elect	4.7MFD/50V.....	431-056509	
C15,18,20,36	Elect	100MFD/50V	431-106509	
C1, 2	Elect	100MFD/25V	431-107259	
C3	Elect	100MFD/15V	432-107159	
LDR-1		Photocoupler	040-049495	
R61	Trimmer	1K	676-000057	
R42	Trimmer	5K	676-000061	
R60	Trimmer	100K	676-000073	

ENDBLOCK BOARD		124-000504	
Q1, 8	NPN Low Noise	001-021260	2N5826
Q9,10,15,16,18, 21,25,27,29	PNP	001-021172	2N4249
Q12-14	NPN	001-021134	2N3392
Q11,17,22-24	NPN	001-021133	2N3393
Q26	PUT	001-026050	2N6027
Q30, 33	PNP	001-021173	2N4249
D1-32		001-226080	1N4148
D33	Zener 15V/1 Watt	001-223028	
LDR-1	Photocoupler	040-049495	
IC1, 2, 5		075-004007	MC14007
IC3, 4, 6		075-004066	MC14066
C61	Tant .56MFD/25V	414-240062	
C62	Tant .68MFD/25V	414-240072	
C66	Tant 2.2MFD/25V	414-240112	
C22, 40	Tant 1.0MFD/35V	414-250092	
C54	Elect 4.7MFD/50V	431-056509	
C68	Elect 10MFD/50V	431-106509	
C50	Elect 200MFD/35V	431-207359	
C67	Elect 10MFD/50V	432-106509	
C48, 49,52	Elect 47MFD/25V	432-506259	
R112	Trimmer Pot 5K	676-000061	
R75	Trimmer " 20K	676-000065	
R7	Trimmer " 250K	676-000077	
POWER SUPPLY BOARD		124-000519	
Q1, 2	PNP	001-022080	T1P32A
D5	Zener 28V/3 watt	001-023046	1N5362
D6	Zener 28V 1 watt	001-023027	
D7	Zener 15V/1 watt	001-023028	
D1-4	Rectivier	001-024052	1N4003
F1	1 amp	016-050547	
C1, 2	.01MFD/1400V	415-110011	
C6, 9	Elect 100MFD/50V	431-107509	
C3, 5	Elect 2000/2200MFD/50V	434-208509	
LESLIE CONTROL BOARD		124-000507	
Q1-3		001-021314	2N3858
Q4		001-021232	2N3403
TR1, TR2	(Triacs)	001-028011	SC137B (G.E.)
LDR1	Photocoupler	040-049496	
REVERBERATION BOARD		124-000166	
Q1		001-021070	
Q2, 3, 8	NPN	001-021133	2N3393
Q5	NPN	001-021232	2N3403
Q7	NPN Low noise	001-021260	2N5826
Q4		001-022032	
D1, 2		001-026080	1N4148
C3, 11	5MFD/5V	407-080539	
C4	100MFD/25V	431-107259	
C6	200MFD/35V	431-207359	
R20	Trimmer 50K	676-000069	

SECTION VIII
DISASSEMBLY PROCEDURE

DISASSEMBLY PROCEDURE FOR 126100

To gain access to printed wiring boards and major sub-assemblies within the organ, perform the following steps:

1. Remove five 5/16" screws fastening back cover to the organ. Remove back panel.

2. Lift vertically on top panel and music rack assembly. Remove assembly.

3. Remove two ¼" screws from side panel mounting brackets (refer to diagram). This allows the rhythm board and rhythm control panel assembly to swing back.

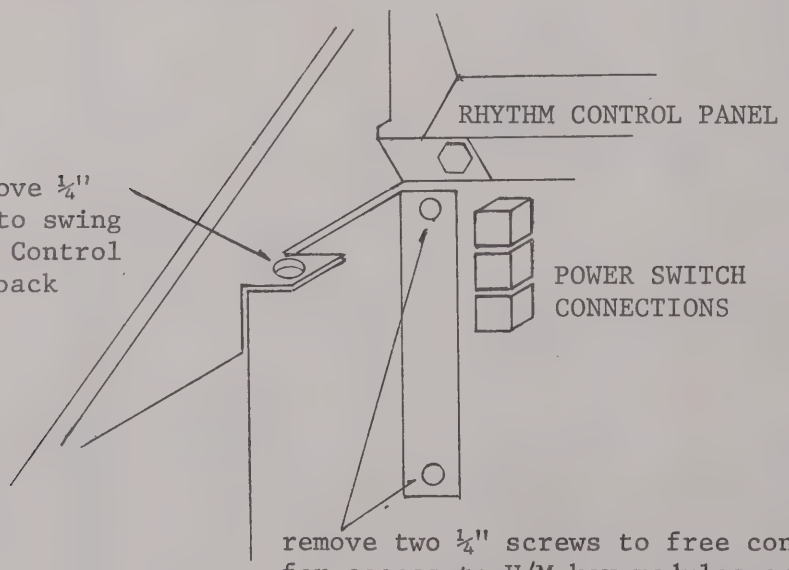
If gaining access to the manual assemblies is required, perform these additional steps:

1. Remove two 7/16" manual hold down bolts from underside of keyboard. They are located directly beneath the upper manual assembly. Swing control panel assembly and upper manual assembly back.

2. To free lower manual, remove two 7/16" manual hold down bolts and one ¼" screw from under keyboard. Unplug Generator Board from lower manual to avoid damage of edge connectors. Lower manual assembly can now be pulled forward to gain access to Note-A-Chord switch, solenoid latching system and SS1 control panel.

To remove upper manual key modules and to gain access to Endblock Board, complete the following step:

1. Locate and remove four ¼" screws holding control panel to side panel mounting brackets (refer to diagram). Control panel can now be moved to provide access to key modules and Endblock Board.


RHYTHM CONTROL PANEL
remove ¼" screw to swing Rhythm Control Panel back
POWER SWITCH CONNECTIONS
identical hardware located at opposite end of instrument
remove screws from each end before moving control panels
remove two ¼" screws to free control panel for access to U/M key modules and Endblock Board

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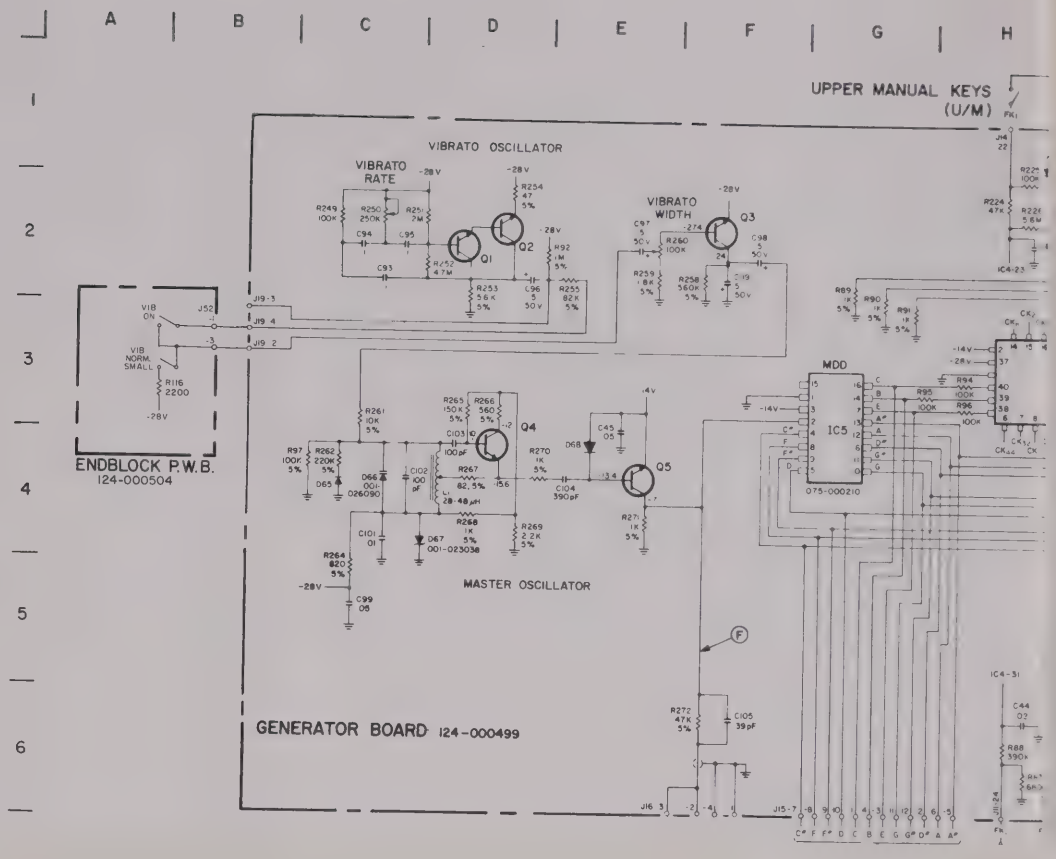
HAMMOND ORGAN COMPANY GRAPHICS COMMUNICATIONS

SCHEMATIC DIAGRAM



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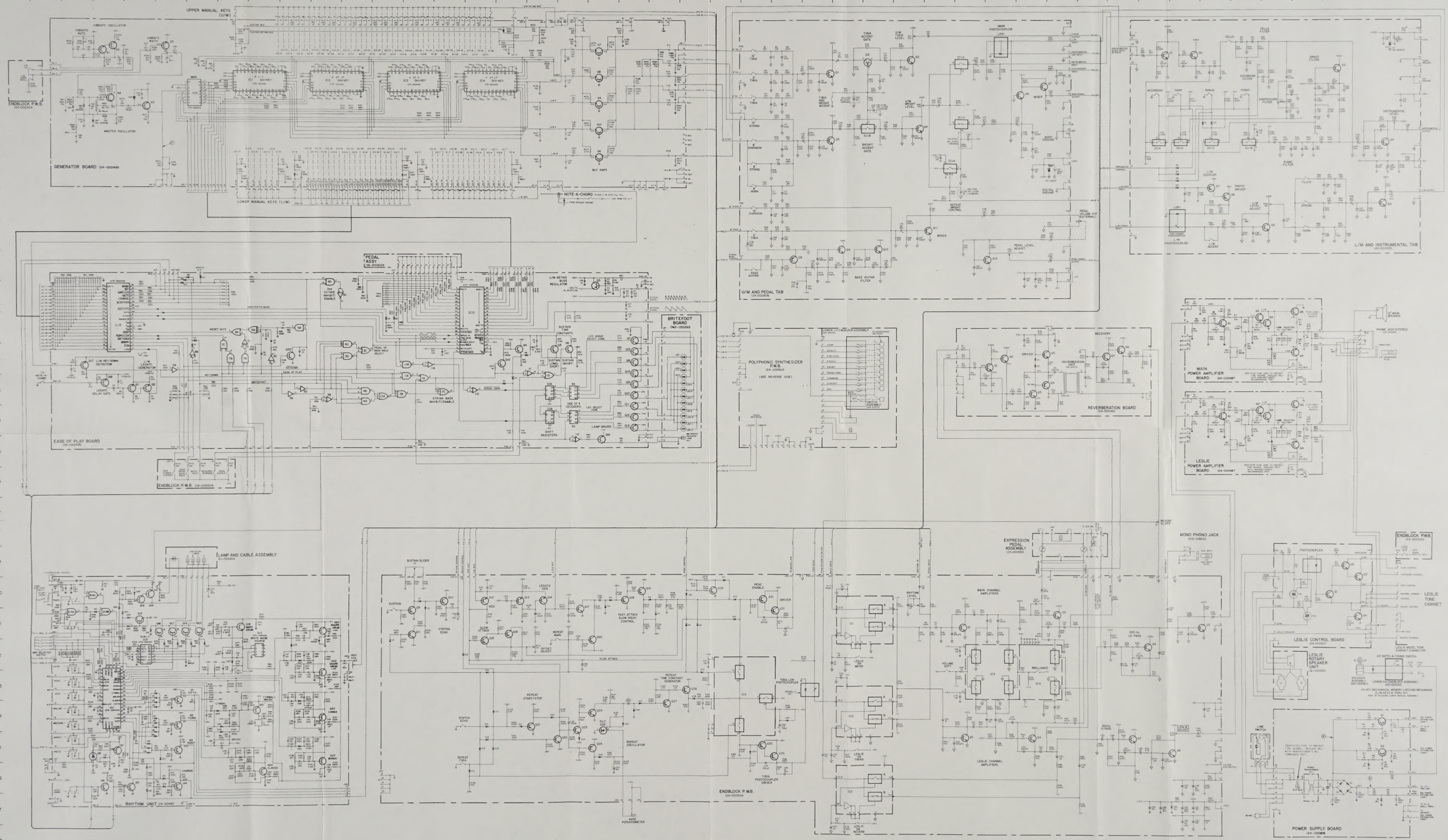
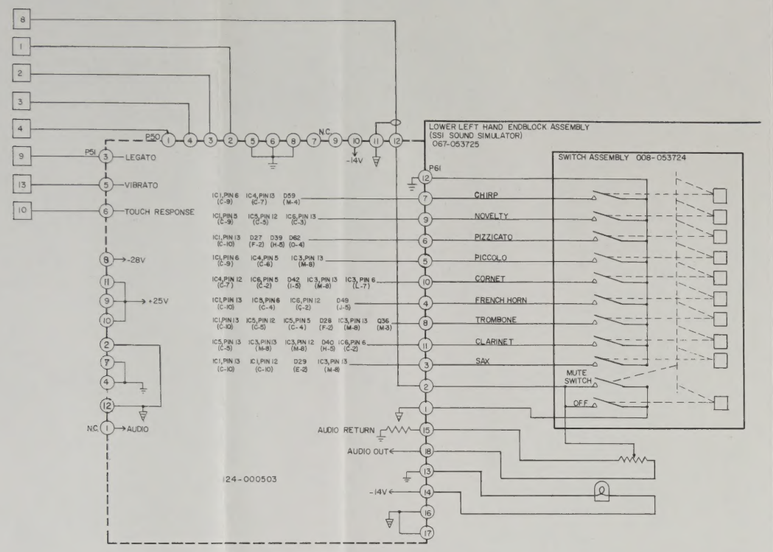
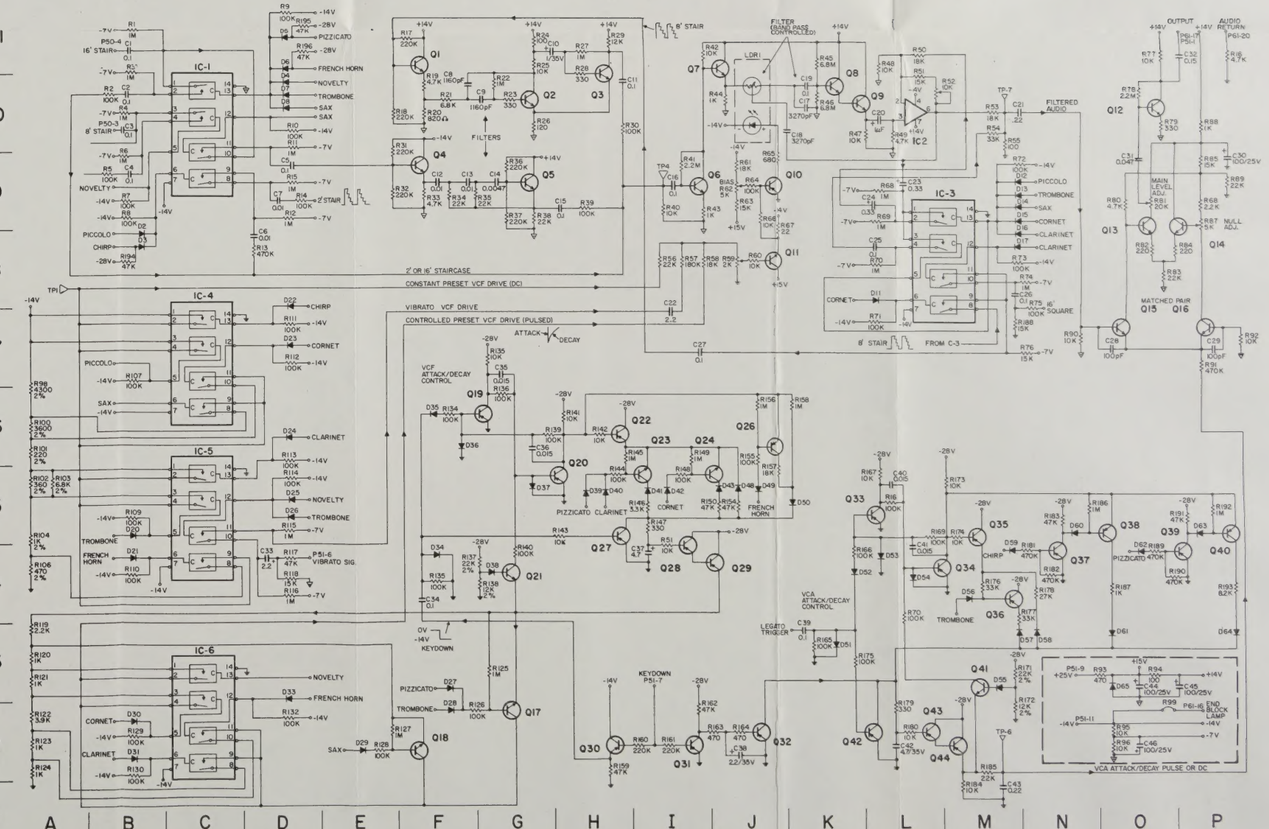
HAMMOND ORGAN COMPANY GRAPHICS COMMUNICATIONS

SCHEMATIC DIAGRAM



126100 SERIES ORGAN SCHEMATIC DIAGRAM



SOUND SIMULATOR I